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Color Specification—Physical, Physiological and Psychological*

Three Factors of Color Science—Physical Color Specifications—Physiological Color Specifications—Psychological Specifications—Modern Investigators

By WALTER M. SCOTT, Ph.D.

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IT is such an ordinary experience to understand our neighbors, because of the common bond of language, that we can scarcely realize the calamity of confusion resulting in the condition described in the story of the Tower of Babel. Even languages foreign to our knowledge are capable of being so readily translated that practically all the works of science and fiction are within the scope of common understanding.

Yet a serious limitation to this condition is found in the field of color. Here there has existed no definite terms or symbols by means of which various color thoughts might be expressed and interchanged in a clear and well-understood manner.

This situation is largely due to the fact that the earlier workers in color did not distinguish clearly between three factors which are included in the science of color, i. e.:

1. Physical—the stimuli which are transmitted by the colored pigments to the eye.
2. Physiological—the excitations in the eye which result from the color stimuli.
3. Psychological—the visual sensations produced by such color excitations.

It is the purpose of this paper to present a brief review of the more important contributions to the science of color,† at the same time classifying them with respect to the emphasis which is placed on the three factors mentioned above.

Physical Color Specification

The earliest colorists could give expression to their ideas only through a very limited number of colored materials, such as mineral pigments and natural dyestuffs. Therefore, their color languages and the accompanying visualizations of the color dimensions in their languages —in the form of "color solids"—were founded largely on color phenomena resulting from the mixture of these pigments or dyes. It was known that three basic pigments—a red pigment, a yellow pigment, and a purple-blue pigment (Ultramarine Blue)—could be mixed together in such proportions as to produce practically any desired color. A suitable mixture of all three of these pigments results in a so-called "black," which in reality is a rather dark gray.

This fact was shown diagrammatically in the form of a "pigment triangle" (see Fig. 1) at the three corners of which were placed the three basic pigments: red, yellow and purple-blue, the center representing "Black." Pigment mixtures on the side between red and yellow gave various yellow-red ("Orange") effects; those between yellow and purple-blue gave green-yellow, green, blue-green, and blue effects; and those between purple-blue and red gave purple ("Violet") and red-purple effects.

J. H. Lambert[1], about 1772, constructed a pigment "pyramid," (see Fig. 2). The pigment triangle, as described above, formed the base of this pyramid, above which were a series of triangles, each smaller than the one below it. These triangles represented the effect of mixing the pigments on the base of the triangle with in-

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†The word "color" is used in this article in the sense as defined by the Colorimetry Committee of the Optical Society of America[7]—i. e., "the general name for all sensations arising from the activity of the retina of the eye and its attached nervous mechanisms." In this sense red, yellow, pink, gray, black, white, etc., are all considered as colors.

creasing proportions of white pigment. The white pigment itself was represented at the apex of the pyramid.

The most thorough exponent of this idea of the pigment color solid was the Frenchman, Michael Eugene Chevreul[2], [3] who, in 1860 and subsequent years, published a number of papers and books on color. Chevreul discarded the idea of a pigment triangle in favor of a pigment and dye circle (see Fig. 3). White, he placed in the center of this circle, while black occupied the entire circumference. Between the center and the circumference he placed pure pigments or dyes, from Red through "Orange," Yellow, Green, Blue, and "Violet" (Purple) back to red. This line most nearly approached the center at Yellow, and departed farthest from the center at purple-blue. Black pigment was added to the roughly ovoid pure pigment line in an outward direction in increments which gave an approximation to equal steps to the eye, and white pigment was added toward the center in the same manner.

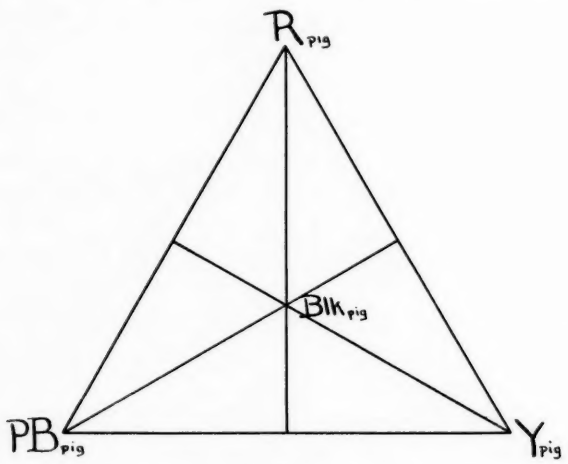

FIG. 1

Chevreul constructed ten of these pigment circles, and arranged them in a series of charts in a form of color atlas. The nine additional circles represented increasing amounts of black pigment added to the pigments in the first circle.

In this way Chevreul was able to present a large number of colors in a logical sequence. He was a very careful experimenter and made a definite contribution to the field of color by presenting specific colored charts containing a considerable number of colors.

PHYSIOLOGICAL COLOR SPECIFICATION

Pigment mixtures lead to surprisingly inconsistent results, so that progressive colorists became unwilling to base their color schemes on the vagaries of pigment mixture. We now know that these apparent inconsistencies were due to the fact that two pigments may match under some given illumination, and yet have quite different light reflecting characteristics in different parts of the spectrum. Since the results of pigment mixture depends directly on such spectral properties, the latter are seen to be the cause of the inconsistencies observed.

Sir Isaac Newton, the discoverer of the spectrum, gave a new impetus to the experimentation in color. He found that three properly chosen beams of spectral light, when mixed together additively, could produce most of the colors then in use. From this he inferred that there were three excitable elements in the retina, one responding chiefly to wavelengths in the red end of the spectrum —corresponding to the pure red spectral beam, a second responding chiefly to the wavelengths in the purple-blue end of the spectrum—corresponding to the pure purple-blue spectral beam, and a third responding chiefly to the green-yellow wavelengths in the middle of the spectrum —corresponding to the pure green-yellow spectral beam. Following this reasoning, he constructed his famous excitation triangle.

The three excitations—R, GY, and PB—were placed at the corners of this triangle (see Fig. 4), the center representing white. Any color was represented by some point on or within the triangle: yellow and yellow-red on the side between R, GY, and White; green, blue-green, and blue on the lower side; and purple and red-purple on the third side.

Newton's discovery led to the development of numerous excitation color solids, based on the simple excitation triangle (see Fig. 5). In its simplest form the excitation solid is an inverted pyramid, with the excitation

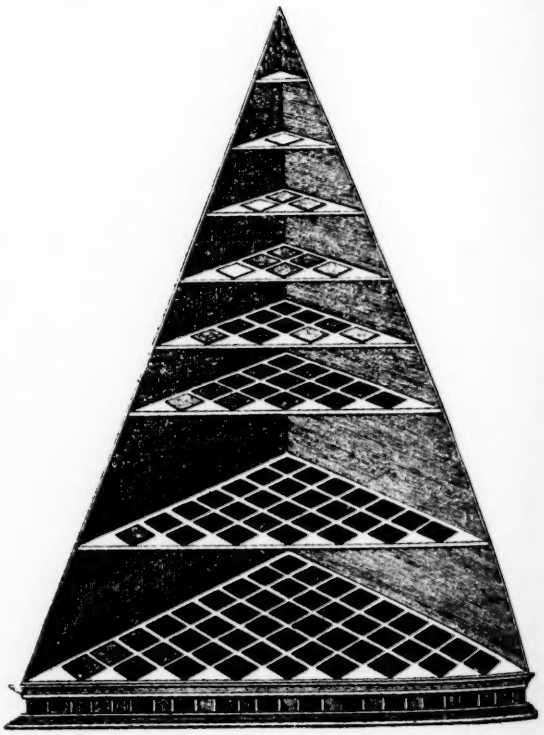

FIG. 2

triangle forming its base above, and with black at the apex below. The line drawn from the white point in the center of the base, downward to the black apex, repre-

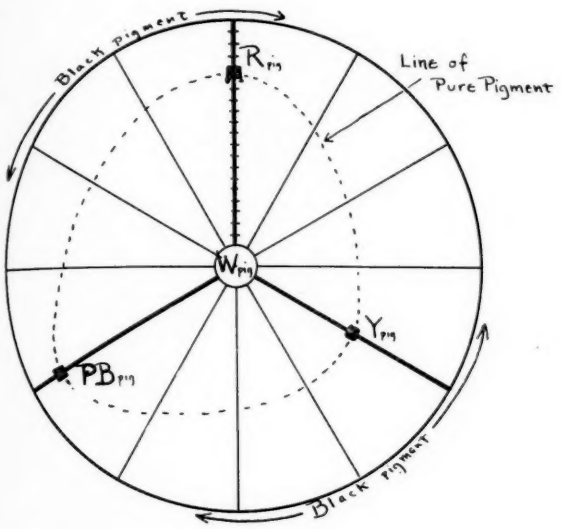

FIG. 3

sents a series of neutral grays of greater and greater darkness.

Several investigators increased the number of excitations from three to four, i. e., red, yellow, green, and purple-blue. Wundt[4] is typical of this group. He describes a double cone on which there were four excitations, as well as white above and black below.

Two characteristics stand out as typical of excitation color solids; first, the excitation points lie in a horizontal plane (they would be more representative if they were in a plane tipped up at yellow and depressed at purple-blue); and second, the excitations are located on radii of the same length, when they should be on radii of such length as to represent their relative color strengths.

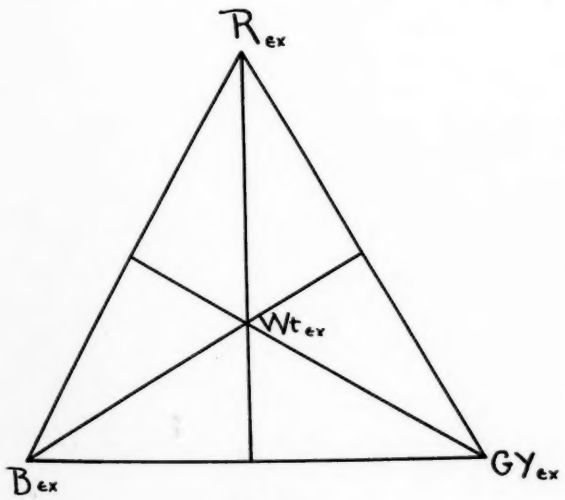

FIG. 4

Quite apart from color solids, a means of specifying colors upon the basis of the relative amounts of light which they reflect at different points in the spectrum, has been developed. It has been found that spectral reflection (or transmission) curves form a unique and physically rigorous specification of any color thereby distinguishing it physically from any other color. These curves are determined on a spectrophotometer, which determines the per cent of pure light which is reflected from (or transmitted by) a colored material, at any given wavelength. The spectral curve is plotted with per cent reflection as ordinate, and wavelength as abscissa.

Five typical spectral curves are shown in Figs. 6 through 10. They represent five colors which appear in the Munsell "Atlas"—red (R 4/10), Yellow (Y 8/9). green (G 5/7), blue (B 4/6), and purple (P 4/6).

Psychological Color Specification

Although spectral curves furnish a fundamental physical specification of a color, their practical use is limited,

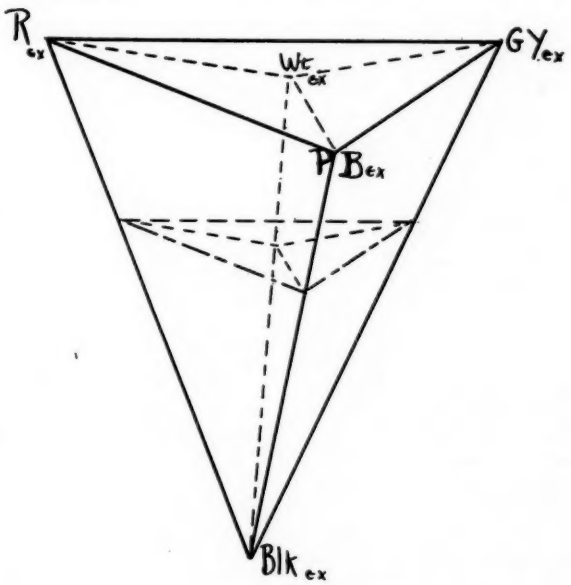

FIG. 5

in some instances, since they specify the physical stimulus which comes *to* the eye, rather than the visual sensation which results *from* this stimulus. For instance, two colors are frequently found which, in some given illumination such as daylight, produce exactly the same sensation (that is they match exactly) but which possess quite different spectral curves.

It has not been until comparatively recent times that psychology has begun to be an exact science. Nevertheless Helmholtz[5], pointed out the most practical basis for a color language or system when he gave to science his clear concept of the three psychological dimensions or attributes of any color. He stated that the quality of every color impression depends on three variable fac-

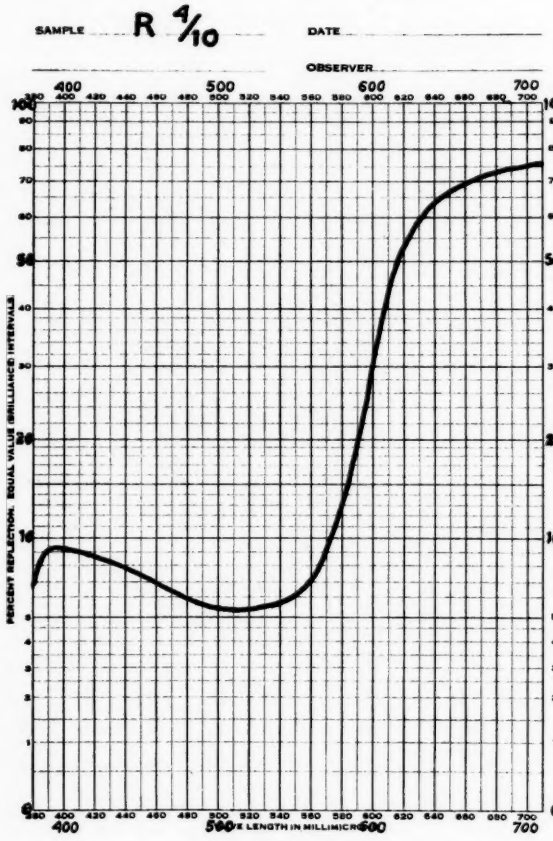

FIG. 6

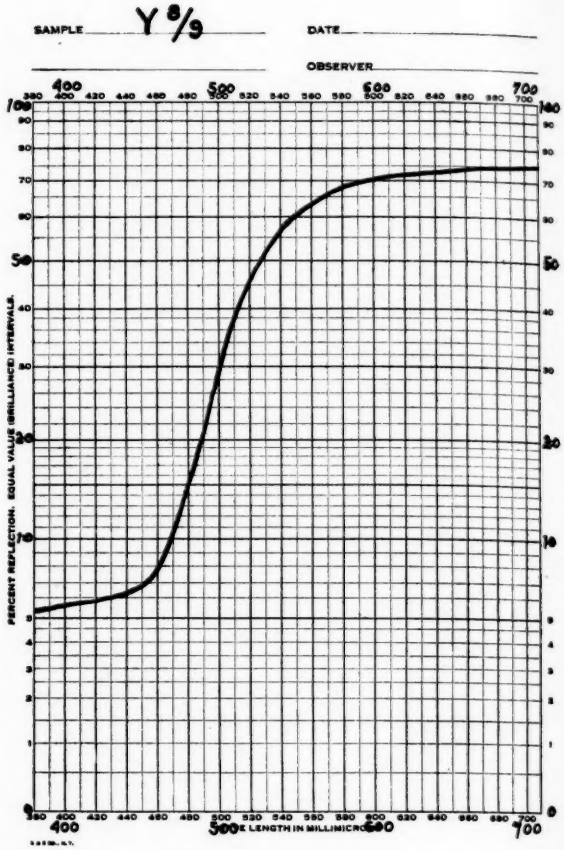

FIG. 7

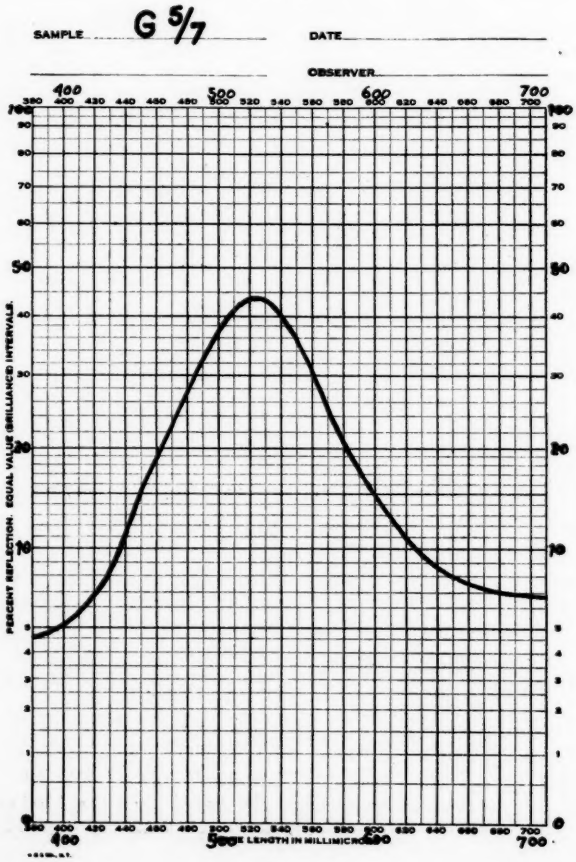

FIG. 8

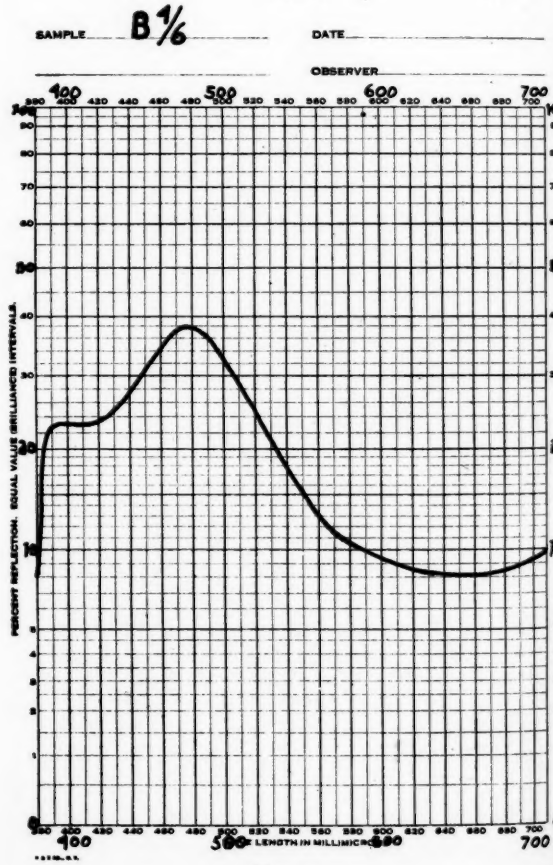

FIG. 9

tors, namely, "hue," "luminosity," and "saturation." Unfortunately many different names have been used to describe these factors, some of which are:

Hue—Color, Shade, Tone, Tint.
Luminosity—Brightness, Brilliance, Intensity, Value.
Saturation—Purity, Color Intensity, Strength, Chroma.

The three terms which have met with very general acceptance were first introduced by A. H. Munsell.[6] These terms are:

HUE—"Hue is the quality by which we distinguish a red from a yellow, a green, a blue, or a purple."
VALUE—"Value is the quality by which we distinguish a light color from a dark one," i. e., a pink from a maroon or a white from black.
CHROMA—"Chroma is the quality by which we distinguish a strong color from a weak one," i. e., a "Vermillion Red" from a reddish gray, or a "Canary Yellow" from an "Old Ivory."

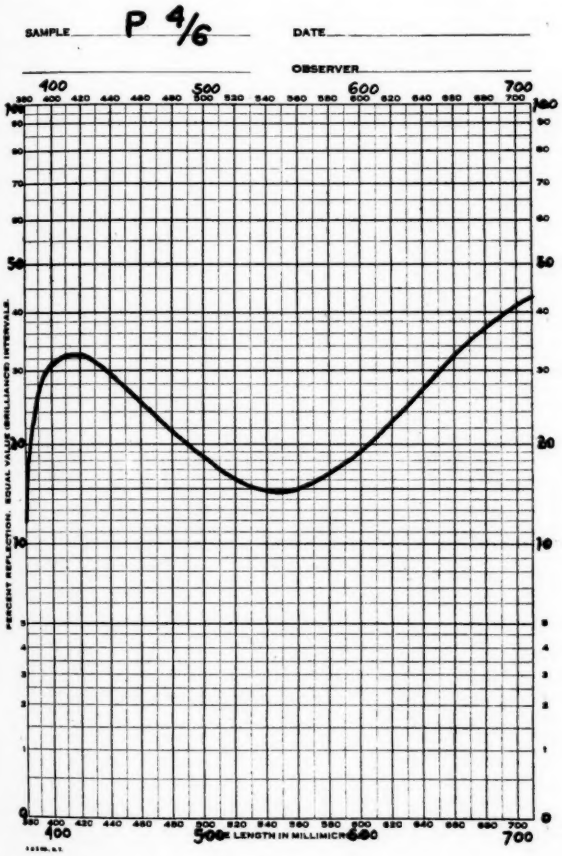

FIG. 10

Mr. Munsell suggested that these three color dimensions could be most easily specified by means of a "Color Sphere" (see Fig. 11). A "Color Tree" may also be constructed to supplement the "Color Sphere" (see Fig. 12). *Hue* is measured on the equator of the sphere, the entire circumference being divided into ten equidistant "major" hues, arranged in the order of the spectrum, i. e., Red, Yellow-red, Yellow, Green-yellow, Green, Blue-green, Blue, Purple-blue, Purple and Red-purple.* Each of these ten major hues are divided into ten subdivisions, making one hundred in all. The major hue is

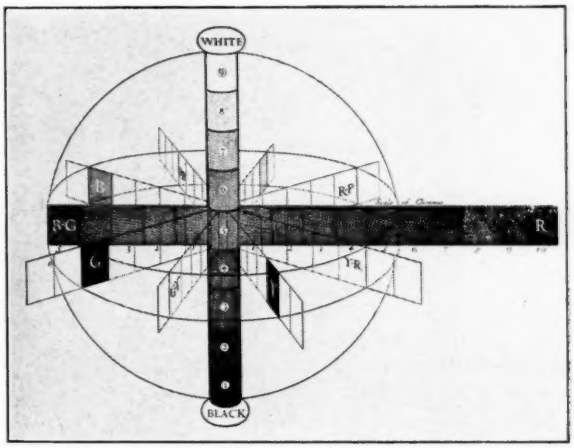

FIG. 11

*Purple and red-purple do not exist in the spectrum, and therefore form a connecting link between the ends of the spectrum which lie on the purple side of purple-blue and on the red-purple side of red.

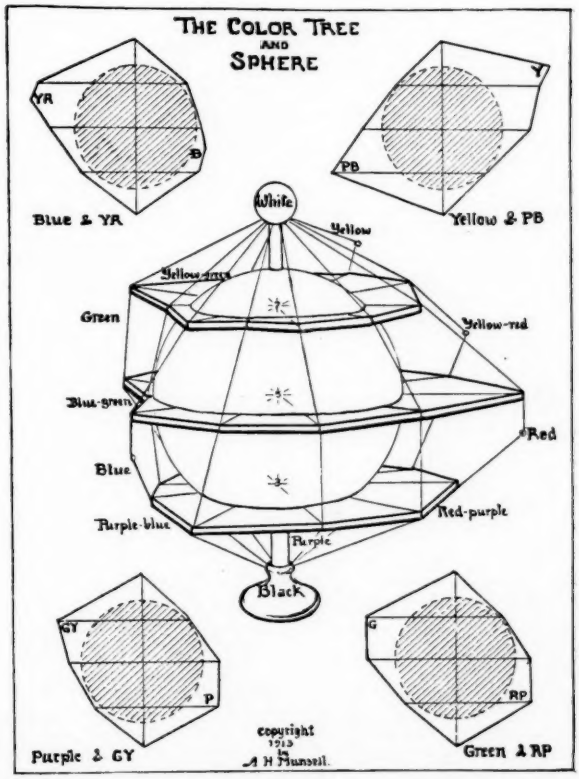

FIG. 12

considered the center of its hue group—the colors five steps on either side of red, for instance, are all related to red, and is given the designation "5" (5 R in the case of red) so that the progression of hues from red to yellow-red is: 5R, 6R, 7R, 8R, 9R, 10R, 1YR, 2YR, 3YR, and 5YR (see Fig. 13).

Value is measured on the *axis* of the sphere, progressing from theoretical black—represented by an aperture in a velvet-lined box—at the lower or south pole, through an ever-rising series of lighter grays to theoretical white—approximated by chalk—at the upper or north pole. All colors on the same horizontal plane in the color sphere

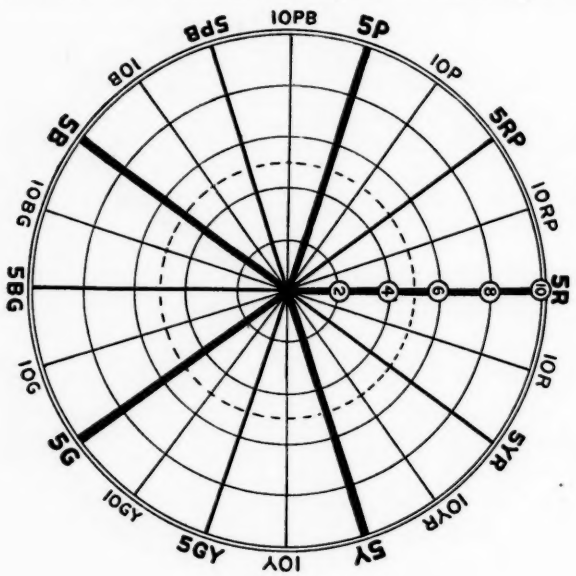

FIG. 13

will have the same "value." Theoretical black is zero (0) and theoretical white ten (10), there being ten steps of grays, equidistantly spaced to the eye, between zero and ten (see Fig. 12). In the "Chromatic Colors" (those other than black, gray or white) there only exist about six or seven value levels, i. e., value two or three (2 or 3) through value eight (8).

Chroma is measured outward on the horizontal *radii* extending from the axis of the sphere toward the circumference (see Fig. 13). Thus all colors which are equidistant from the axis have the same chroma. The notation for chroma is decimal extending in the red, for instance, to about twenty (20) steps for pure spectral light of a wavelength of 620 mμ. Most reds fall inside of fourteen or fifteen (14 or 15) steps of chroma. This notation may always be expanded if stronger colors are found.

The complete psychological designation of a color is very simple. For instance, a color might be five and a half red in hue (5.5R), four and three-tenths steps up from black in value (4.3/) and ten and a half steps (/10.5) outward from gray in chroma and would be written: "5.5 R 4.3/10.5"

This paper has briefly traced the evolution of color understanding and classified some of the well-known color theories according to the angle from which their authors approached this subject. It would not do to conclude without some mention of the excellent work of two modern investigators, Ridgway[8] and Ostwald[9, 10, 11, 12].

Ridgway published a book of color charts containing 1,115 named colors which is very useful for reference purposes. Ostwald developed a color theory and a method of color measurement based on this theory. The color systems used by both of these men cannot be specifically classified in any one of the groups mentioned in this paper, as they include portions of both the physiological color theories.

It is hoped that this paper has served to point out: first, the lesson to be learned from past experience, i. e., that we must distinguish carefully in our own minds between the physical, physiological and psychological specifications of colors; and second, the necessity for future research work to establish correlations between these three factors.

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RAYON LAUNDERING DIRECTIONS GIVEN TO MACY'S PATRONS

Directions for the successful laundering of rayon fabrics have been prepared by the Macy Bureau of Standards and are now being supplied to the store's customers. Rayon fabrics are tested by the bureau for their washability and their breaking strength before being placed on sale in the Macy store.

The directions evolved by the Macy bureau follow:

"Washing.—Use pure soap. Don't use water warmer than wrist temperature. Wash quickly. Don't rub—squeeze. Rinse thoroughly. Don't twist garment—press water out with hands. Remove excess moisture between towels rapidly.

"Drying and Pressing Knitted Rayons.—Handle gently while wet. Shape garment to original size. Dry preferably flat. Hang away from heat or strong light. Don't use clothespins. Don't use a hot iron. Press dry, and if wrinkled use a damp cloth.

"Dry and Pressing Woven Rayons.—Remove from towels immediately. Shake gently until almost dry. Fashion garment to original shape. Press on wrong side with a moderate iron while slightly damp. Don't sprinkle—if too dry iron over an evenly damp cloth."

Modern Apparel Dyeing Industry Assuming Important Proportions

Rehabilitation of Apparel More Complete—The Colorful Era—Processes of Garment Dyeing—Shade-Matching Trouble

By GEORGE RICE

THE conditions which have combined to elevate the apparel dyeing industry to important and profitable proportions in practically every city and large town in the country are not many but they have been effective. Anyone can make this discovery by visiting a number of modern garment and window drapery dyeing plants and interviewing the superintendent and some of the foremen. An old-timer will note a great improvement in the equipment and methods of dyeing as compared with the poorly equipped dyehouses of the period when many garments were dyed with straw hat dyes or some ready-for-use coloring substances purchased at a drug store.

The dyehouse usually was nothing more than an integral part of a dry-cleaning plant or a laundry, and someone who could be spared from the cleaning or washing was detailed to dye the suit or the curtain. Poor dyeing resulted and many a good suit was discarded before its time because of a faded or unsatisfactory color. The dyeing of garments was not very popular until men began to specialize in this branch of the industry. Competent dyers of wool, silk and cotton in the loose stock, the yarn or the piece realized the opportunities that garment dyeing offered if the same standard of science and art used in the mill were applied. Some of these dyers went over to the garment dyeing industry, taking with them the experience of years in the selection of dyes and chemicals. They had to abandon many of their methods of dyeing, for instead of having clean stock to handle they had all kinds of old, worn, soiled, mildewed, moth-eaten apparel of many colors and fibers thrown at them in heaps with orders to make them look like new.

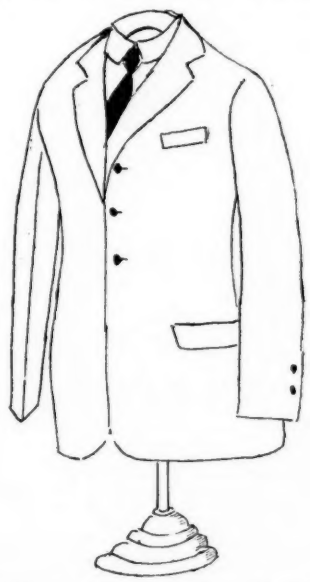
But they were dyers, they were familiar with the dyestuffs and that helped. All dyeing was done by poling in wooden tubs inefficiently fitted with steam connection as a rule, although copper jacketed kettles and round vats provided with revolving paddles to circulate the liquor were in occasional use. The dyers put in modern dyeing machinery in some cases, but depended mostly upon perfecting the dyeing processes to popularize the business. Builders of up-to-date garment dyeing machinery have made good progress in recent years, and many of the best garment dyeing firms of the country have installed the same with satisfactory and profitable results. But the average apparel dyer receives such a variety of shapes, sizes and kinds of articles to color that even in this present age of high production and art he relies to some extent on the common tub and pole. But when he receives a quantity lot of clothes or drapes from a clothing manufacturer or upholstery concern to color a shade in vogue over the color which went out of style overnight, he is glad enough to have his dyeing machinery at hand.

These dyers who came from the mill dyehouses, or who in recent years have made apparel dyeing a specialty, have put art into the industry, and made it a close second to the dry-cleaning business.

Rehabilitation of Apparel More Complete Now

Another thing which has tended to augment the trade of the modern garment dyeing establishment is the fact that more attention is given to the rehabilitation of the garments than formerly. An old garment often went direct into the dye liquor without any effort to get the dust out of it or remove stains or soiled places.

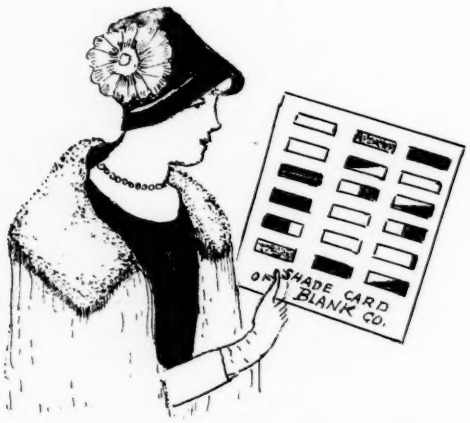
The practice of stripping the old color or colors before dyeing the new color, which is common now,



Regardless of the soiled, ragged, wrinkled, and dilapidated condition of apparel presented for dyeing, the customer expects it to be made to look like new.

was not bothered with very often, even when it was known that such colors would loosen up in the bath and impair the new color.

The preliminary processes in the modern dyehouse include not only a thorough dusting and washing of the goods, but in the event that such washing does not appear to be effective and stains still remain, the article is sent into the dry-cleaning section of the plant and dry cleaned. The article must be evenly dyed regardless of the additional cost of dry cleaning. Consequently the customer gets a garment which has



The distribution of shade cards containing the fashionable colors of the season has extended the color range of apparel dyeing far beyond the old-time blacks, blues and browns.

been rejuvenated into a state of newness that pleases. Garments that go into a dye plant impinged with an odor, spotted with grease or ink stains, the color either devoid of its original luster or old fashioned, a seam opened here and there, plentifully wrinkled and otherwise unpresentable, and come out clean, odorless, rich in color, soft of handle, rips sewn, buttons replaced, neatly pressed and delivered at a moderate price, are proving to the public that it pays to patronize the garment dyers.

The Colorful Era Another Factor

Business in all gament dyeing plants has benefited by the color fad which has invaded every walk of life. In one dyehouse we were shown hundreds of suitings of men, women and children for redyeing on which the color was still fresh and good to look at, but out of style. When the colors of the garment dyer were limited, and sometimes fugitive, it was seldom that either apparel or drapery was received in any such wholesale lots as now.

The distribution of shade cards, made up similar to the shade cards issued by the manufacturers of dyestuffs, among the homes of the locality has increased business for many garment dyers. Women that used to redye garments with home dyes are now sending their best fabrics to the garment dyers who are advertising this way. The publicity feature was not considered important in the old days. Dyers argued that if a person had a suit to dye, its owner would bring it in for coloring in due course. The dyers are advertising now and they are inducing people to get discarded attire out of hiding to be salvaged by the application of a stylish color and are saving money for their owners.

Process of Dyeing

I noticed that the boss dyers who were doing the most business, and having the best success were those that possess a technical library right in their work room. These libraries contain copies of the trade's leading journals bearing evidence of having been read, and shade cards of dyestuff manufacturers. The technical information in both the journals and the shade cards is of great value even to old dyers, because of the numerous shades in vogue and the many kinds of textiles met with since the manufacture of artificial fabrics began on a large scale. The information relative to preparing the garments for dyeing, directions for stripping the color when necessary and for the dyeing of garments which need not be stripped, is of more service to many dyers than the publishers know. The bulk of the garments taken in for dyeing used to be woolen and were so called, although a percentage of cotton was almost always present. Today the daily receipts include nearly as many silk or near-silk garments as the other sort.

Rayon and other synthetic fibers are common, in the form of well-made, serviceable garments usually dyed handsomely and efficiently, but the shade has gone into the discard with the change of style and a modish shade must be put on.

If the article is wool or wool and cotton, and has been cleaned, it is put in with others of the same kind so as to make a batch of a profitable size to handle unless a rush order requires a single article to be put through alone. The dye bath is prepared with about 25% Glauber salt crystals based on the weight of the garments and is heated to a temperature of about 170° F. and the goods entered. The temperature is then brought to the boiling point and kept there for a quarter of an hour, the steam shut off and the garments worked in the cooling bath for half an hour or longer if necessary and then taken out. They are worked in the bath a second time if the color does not come up to requirements. Some of the dark shades require nearly an hour of poling. Then the goods are rinsed in clear water or in a bath containing a little acetic acid and hydroextracted and hung in

the dry room, after which they are ready for finishing.

Some dyers are steaming the goods before hanging them in the dry room, as the steaming tends to prevent the development of wrinkles which sometimes are hard to level. Some contend that the steaming process prevents shrinkage, but as the normal shrinkage of a garment during dyeing is not very much, and often none whatever, it hardly pays to steam for this purpose alone.

The garments are now ready for the finishing and here is where defects become visible.

They were fussing about the dyestuffs in one place where some of the garments which were dyed in the same batch did not shade right, garment for garment, and in some cases shaded unevenly in single garments. I watched a large batch in process of dyeing and noticed as almost anyone else might notice, that while the vat boiled furiously on one side the bath appeared apparently calm on the other. Although the garments were worked around, there were times when they were at a standstill just long enough for the faster and more energetic action of the side of the bath which boiled the most intensely to slightly darken the shade. It was caused by a defective arrangement of the heating system, which later on was corrected, so that the liquor boiled evenly on both sides of the vat.

The Effect of Sunlight and Perspiration Upon Weighted Silk Fabrics

By Margaret Furry with Rachel Ed[illegible]
Department of Chemistry, Iowa State College

FIVE silk taffetas were studied in an attempt to determine quantitatively the deterioration of these fabrics due to the action of sunlight and perspiration. Analyses of these taffetas are given in the following table:

TAFFETA	A	B	C	D	E
1. Price per yard [2]	$2.72	$2.31	$1.81	$2.01	$3.48
2. Color (not sunfast):					
(a) Warp	blue	blue	yellow	gray	blue
(b) Filling	blue	blue	green	rose	blue
3. Wgt., oz. per yd.[2]	1.88	1.50	1.35	1.50	1.47
4. Percentage gloss.	51.0	91.0	19.0	21.0	85.0
5. Thickness, inches	0.0046	0.0046	0.0039	0.0035	0.0045
6. Ash:					
(a) Percentage:					
1. Total	0.5	30.4	30.2	33.0	12.8
2. Warp yarn	0.5	23.5	22.1	25.3	1.1
3. Filling yarn	0.4	39.4	38.4	42.2	26.2
(b) Qualitative analysis:					
1. Aluminum.	—	+	+	+	+
2. Calcium	—	—	—	+	—
3. Iron	—	+	—	+	+
4. Magnesium	—	—	+	+	—
5. Phosphates	—	+	+	+	+
6. Sulphates	—	+	+	+	+
7. Tin	—	+	+	+	+
7. Yarns per inch:					
(a) Warp	248.6	162.3	142.3	168.3	248.3
(b) Filling	84.6	83.6	89.6	92.3	93.0
8. Yds. yarn per lb.					
(a) Warp	15,428	14,264	14,135	13,897	18,050
(b) Filling	6,620	7,120	6,852	6,852	7,280
9. Yarn diam. inches					
(a) Warp	0.0081	0.0084	0.0085	0.0086	0.0074
(b) Filling	0.0123	0.0119	0.0121	0.0121	0.0120
10 Yarn twist:					
(a) Warp:					
1. No. per in.	27.0	31.0	26.0	13.0	36.0
2. % Deviation	14.0	8.0	8.0	12.0	5.0
3. Direction	R	R	R	R	R
(b) Filling:					
1. No. per in.	0	0	0	0	0
11. % Moisture	4.6	5.1	4.5	6.4	4.4
12. Water extract:					
(a) Percentage	12.7	7.5	8.4	10.4	4.1
(b) Qualitative analysis:					
1. Calcium	+	—	—	+	—
2. Fehling's test	+	—	—	—	—
3. Magnesium	+	—	+	+	—
4. Protein	+	+	+	+	—
5. Sulphates	—	—	—	+	—
13. Ether extract:					
(a) Percentage	0.9	0.7	0.3	0.3	0.3
(b) Test for mineral oil [3]	+	+	—	—	+
14. Tannin [3]	+	—	—	—	—
15. Breaking strength and elasticity:					
(a) Temp., °F.	83.0	83.0	83.0	79.0	81.0
(b) % Relative humidity	78.0	83.0	83.0	82.0	70.0
(c) Warp:					
1. Breaking st'ngth, lbs.	53.0	27.0	22.0	22.0	41.0
2. % Deviation	2.0	3.0	4.0	7.0	4.0
3. Elasticity	19.0	20.0	15.0	12.0	22.0
(d) Filling:					
1. Breaking st'ngth, lbs.	33.0	20.0	20.0	13.0	33.0
2. % Deviation	9.0	8.0	9.0	21.0	5.0
3. Elasticity	13.0	6.0	12.0	0.0	6.0

In the above table fabric weight and yarn count are expressed as 111% of the dry weight (105° C.). Percentage moisture is calculated in terms of the air-dry fabric. Water extract, ether extract and ash are expressed in terms of the dry weight (105° C.). The other methods of fabric analysis used have been previously described.[2]

Test specimens of the taffetas were exposed to sunlight under glass for forty days in a fading frame tilted 20° from the horizontal and facing south. The period of exposure for the untreated fabrics was from December 11, 1926, to January 20, 1927; the treated fabrics were exposed from January 20 to March 1, 1927.

Breaking strength (strip method) was used to measure fabric deterioration. This test was made with fabrics exposed to the sunlight for forty days and with fabrics treated with imitation perspiration solutions,[1] dried over sulphuric acid in a desiccator for forty days and then exposed to the sunlight for forty days. The results of these tests are given in the table which follows:

Percentage Decrease in Breaking Strength

Perspiration treatment	None		Acid		Alkaline	
Conditions of test:						
(a) Temperature	83		74		74	
(b) % Relative humidity....	68		65		65	
(c) Direction of fabric.....	W	F	W	F	W	F
Fabric A	7*	4*	2*	10*	10*	7*
" B	36	46	65	97	24	70
" C	69	88	98	100	66	67
" D	53	100	91	98	49*†	100
" E	14*	29	8*†	28	12	8

*Not weighted. †Increase.

SUMMARY

1. One unweighted taffeta, one taffeta weighted only in filling yarns, and three taffetas weighted in both warp and filling yarns were analyzed as to structure, finish and breaking strength.

2. The percentage decrease in breaking strength of these taffetas (with and without previous treatment with acid or alkaline perspiration solutions) was determined after forty days' exposure to sunlight.

3. The weighted taffetas (with or without previous perspiration treatment) deteriorated more rapidly upon exposure to light than the unweighted taffeta.

4. The taffetas subjected to acid perspiration treatment deteriorated more upon light exposure than those subjected to alkaline perspiration treatment. The deterioration of the latter was somewhat less than that of the untreated fabrics.

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1. American Association of Textile Chemists and Colorists' Year Book, 1925. Howes Publishing Company, New York City.
2. M. Furry, with R. Edgar, Jour. Home Economics **20,** 429 (1928).
3. J. M. Matthews, Application of Dyestuffs, 1920. John Wiley & Sons, New York City.

STUDY RAYON AT BUREAU OF STANDARDS

Special Testing Procedure and Equipment

THE physical and chemical properties of cellulose fibers are being intensively studied in the textile testing laboratories of the United States Bureau of Standards, according to information published in the Bureau's Technical News Bulletin.

The work on rayon at the bureau has centered chiefly on the study of effects of moisture on strength and elongation properties. Actual work along these lines was delayed pending the development of special testing procedure adequate to this type of research and the design of the necessary equipment.

The method for obtaining stress-strain curves, using a multiple-strand specimen, has been refined considerably. In developing this method yarns of other textile fibers besides rayon were studied for comparison. The data obtained are being collated for publication.

This multiple strand strength method consists, essentially, of winding the yarn under controlled uniform tention on to a specimen holder which in turn may be placed in the jaws of the testing machine without further handling.

Using this method, comparative results are being obtained on all four types—viscose, cuprammonium, nitrocellulose, and cellulose acetate. Different relative humidities are being used which will indicate what effect the moisture has on strength and stretch.

For the wet tests a device has been designed and built which consists of a tank built around the lower jaw of the Scott tester. This tank is equipped with heaters and temperature control. This equipment permits the specimens to be immersed in water for definite periods of time and under controlled temperature. It is then broken without further manipulation. It has the advantage that the yarn is not handled from the time it is inserted in the jaw until the test is completed.

Some supplementary work is being done on the cellulose acetate type of rayon to determine what takes place when the rayon is boiled in water. It is recognized that a delustering action results, and that the properties of the rayon are effected in various ways. The results have indicated that little, if any, regeneration of the cellulose acetate to cellulose takes place as has been advocated in some theories.

Some preliminary work was done to determine the effect of high pressure and of cathode-ray exposures on rayon. This showed little promise and was not continued.

LEONARD LITTLE NOW MANAGES SLATERSVILLE FINISHING CO.

The appointment of Leonard S. Little as general manager of the Slatersville Finishing Company, Slatersville, R. I., has been announced. L. H. Ballou will continue his active association with the mills as vice-president.

Mr. Little came to the Slatersville Company from Joseph Bancroft & Sons, of Wilmington, Del., where he held the position of works manager. For many years prior to this connection he was with the Pacific Mills, first at Lawrence, Mass., and later as general superintendent of the Pacific's plant at Lyman, S. C. Mr. Little was largely responsible for the layout and plans of the Southern branch and supervised construction in detail.

Born in New Bedford, Mass., in 1886, Mr. Little is a graduate of Brown University and gained his early experience in the industry through connections with the United States Finishing Company and the Apponaug Company in Rhode Island.

The Disco Dyeing Corporation, Paterson, N. J., recently formed with capital of $200,000, to operate a dye plant, will be represented by R. C. Peardon, 492 East Nineteenth Street, one of the incorporators.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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OCTOBER MEETING OF THE RHODE ISLAND SECTION

The October meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held on Friday evening, October 26, at the rooms of the Providence Engineering Society. John Hutton, Chairman, presided.

Dr. Eugene Schwarz, who is in charge of the Vat Color Department of the General Dyestuff Laboratories in New York, delivered an address entitled "New Developments in Vat Colors." This paper will appear in an early issue of the Proceedings.

Ninety members and guests were present.

ALBRO N. DANA,
Secretary.

NOVEMBER MEETING OF THE NEW YORK SECTION

THE November meeting was held Friday evening, November 23, in the Building Trades Employers' Association rooms, New York City.

The dinner was attended by thirty members, and the meeting proper convened at 8.15 p. m. with Mr. Knowland in the chair. The minutes of the October meeting were read and approved, no Treasurer's report was made and Mr. Wolstenholme reported that he expected an increase in membership of the New York Section. The speaker of the evening was Dr. E. W. Pierce, who read a paper on the subject of Silk Dyeing. A committee was appointed to take care of arrangements for those members who planned to attend the Annual Meeting in Providence.

Dr. Pierce's paper and a report of the discussion and of the Question Box session follow:

Silk Dyeing

By DR. E. W. PIERCE
Ciba Company, Inc.

WHILE it is difficult to select a subject for a paper to be read at a meeting of this kind which will be of interest to all present, I believe you will be interested in hearing how the practical silk dyers operate and how their technique often varies from the standard methods of the laboratory, textbook or sample card.

Almost without exception, the silk dyer is without general technical training. He has learned his trade as he has worked his way upward in the dyehouse

and his mental progress has kept close pace with his muscular development. I do not refer to those in the executive positions, for here we find many carefully trained textile chemists and colorists from the foreign centers of the silk industry, but these men are generally in the offices and laboratories and are usually more concerned with general management and production than with the details of the dyer's work.

The first class of silk dyeing to be considered is skeins. A skein dyehouse may handle raw silk, souple, tram, organzine (generally called organ), thread and chappe.

Raw silk is dyed as such in very limited quantity, principally for millinery goods. The gum is not removed and it is simply given a short dip in a warm dye bath, using basic or quick dyeing acid colors and given only one turn, as it is likely to tangle and become unmanageable in the winding operation. There is seldom any effort to match shades closely in this class of work and the whole operation is only a step ahead of the application of throwster's tints.

Souple is a term applied to a dull silk, usually used as filling in ribbons and broad silks. It is a silk from which only a part of the gum has been removed. This is done by working in a warm bath containing tartaric acid; the following dye bath being kept cooler than with bright silks as there might be a loss of more gum and the silk would become too bright to pass as souple.

Having dismissed these two varieties with a mere mention we may now turn to the bulk of the silk dyer's work, although it may be noted that skein dyeing to-day is but a fraction of what it was ten years ago. The advantages of piece dyeing and printing have almost put the Jacquard loom out of business, so that skein dyeing is done mostly to meet the needs of manufacturers of ribbons, linings and sundry fancy fabrics, whereas formerly it was the most important branch of silk dyeing.

The Boil-Off Equipment

A silk dyehouse has some features that will not be seen in cotton or wool establishments. Whether machines are used or not, there will always be two or more long boxes (they use the term box rather than tub, kettle or tank), lined with canvas, which are used for the boil off. Steam pipes are seldom fitted in but are arranged to swing about on universal joints so they can be lifted and used in all the boxes within their radius. Smaller boxes of copper, occasionally wood, are placed wherever there is working space, and if water is not near at hand, there are plenty of large troughs or pipes to bring it from the nearest outlet. The steam system insures that a dyer will not have steam bubbling into his dye bath while he is dyeing, as undue agitation of the liquid would cause tangling and spoil the winding qualities of the silk.

The lots are made up and sent to the dyehouse with the tickets properly made out, samples to be matched and a count of the number of skeins, which is more important than weight, for a loss of weight is expected, but any shortage in the number of skeins calls for an explanation.

The boil off, stripping or degumming bath is made up with about 35% of pure green olive oil soap (based on the weight of the silk), although some dyers use a neutral oleic acid soap, known as brown soap, with equally good results. In skein dyeing there is a strict rule on the soap question, and no soluble oils, silicate or other alkalies will be permitted, for reasons you will see later.

The skeins are hung on sticks, two hands, of four, five or six skeins apiece, to each stick and the boil-off bath raised to about 200° F. (silk dyers, however, use the Reamur thermometer) and the skeins entered and allowed to hang for a half hour without turning, when they are given one turn and left another half hour and turned again, and again if necessary. When free of gum they are lifted and rinsed in two fresh waters and finally in water acidulated with hydrochloric acid. It can be easily seen that this procedure takes no account of variations in the quality of different lots. Soft-natured silk gets just as much boil off as hard-natured lots, so that when the final inspection comes and some silk is seen to be flossy, it is ascribed to the fact that it must have been a soft-natured silk. Any silk skein dyer who wishes to lessen or eliminate claims for damages will find it profitable to make a mirror, or winding on a black card, and also a trial boil off, so he has a general idea of the quality of the silk before he takes one step in the direction of assuming responsibility for the whole lot.

The boil off being completed, the lots go either to the dyers or to the weighting department. The soap liquor is reinforced by the addition of one-third the original amount of soap and used again. Each boil-off bath serves for three or four times, although some dyers use two soap baths, taking an old bath for a first boil and a fresh bath for a second, which in turn becomes a first bath for the next lot. When the soap has been used three or four times it has become charged with dirt, silk gum, animal, vegetable and mineral oils and dyes from the throwster's tints. It is generally diluted with its own bulk of water and pumped to a storage tank on the roof. The dilution

prevents it from gelatinizing and facilitates the settling of the dirt. It is now called gum soap and forms one-half of every dye bath, the rest being water.

The silk dyer handles his dyestuffs in a manner that has much to recommend it. In a carefully managed silk dyehouse it is not permitted to bring any dry dyestuff powders; they are made up into solutions in a separate building or shed and kept in the dyehouse in a row of kegs or barrels, from which the dyers get their supplies as needed. Some dyers work on a rule-of-thumb basis, while others make all dye solutions of a definite strength and have a fair idea of how much they use. Five pounds to a barrel of solution means that a gallon bowl or dipper equals one-tenth of a pound, a pint cup is one-eightieth of a pounds or a fifth of an ounce and a spoon, of one-ounce capacity, equals one-eightieth of an ounce of dye. Naturally they never think of these equivalents, yet they become very expert in matching shades in the shortest possible time.

Testing by Taste

The dye bath is prepared by running the box half full of gum soap from the tank on the roof. On Mondays in summer it is a very odorous operation, reeking with all the by-products of protein decomposition. The box is filled with water, heated to about 120° F. and acidulated with sulphuric acid. Test papers and pH determination sets are unpopular among silk dyers, so he tastes it to see whether it is really acid. Efforts have been made to introduce the safe formic acid, but I believe a mixture of formic and sulphuric acid is as far as they care to go. The dye is added according to the ideas of the dyer, but he must first make a trial, so he dips out a copper bowl full and separates a small part from the skein, which he dips twelve or fourteen times in the dye. This, being squeezed out, shows him what colors need to be increased, and when he has the bath to his liking he enters the lot, gives it about five turns and dries a sample.

As you can readily see, the broken soap bath is a complex mixture of emulsified or dispersed fat acids from the decomposed soap, oils from the throwing, some animal or vegetable and some mineral oil, all kept in a good state of dispersion by the colloid r[illegible] ter from the silk gum and mixed with dyes from the throwster's tints, which are either probably unsuited for making the desired shade or are lacking in level dyeing properties.

Where brilliancy alone is wanted, basic dyes are used and if some fastness to water is required they are given an after-treatment with tannic acid, but it is only a question of time when they will use products like Katanol for this purpose.

The whole range of acid dyes is used and these, too, are often given an after-treatment with tannin to improve their fastness. Direct cotton dyes, developing dyes and various neutral dyeing acid colors are all used where the requirements of shade and fastness call for them.

Many silk dyers like to combine such natural dyestuffs as Archil with acid dyes. I have seen dyers make a whole range of shades on sewing thread, using only Archil, Azo Yellow and Wool Green S. In this connection we must note the use of Sumac Extract with acid dyes. Some dyers dye the shade first and then add the Sumac Extract, while others put the Sumac in at once with the dye. In either case the silk takes up tannin to such an extent that they are able to regain the weight that was lost in the boil off and bring the silk back to par. This form of weighting is used extensively in linings and does not show ash when burned.

There are also shades dyed on chromium and alumina mordants with alizarines or other mordant colors. Vat dyes are becoming more and more popular, especially on sewing silks, but a discussion of these had better be the subject of a separate paper.

Machine dyeing is favored in the better class of skein dyehouses, because it is less harmful to the silk and decreases the large item of labor costs. The machines are the Buhlmann, Weidemann, Smith-Drum, Klauder-Weldon, Hussong, all of which give excellent results on different classes of work.

Weighting—Simple in Theory

If the order on the lot had called for weighting it would have specified 16/18 or 24/26 or some such number. An allowance of two ounces is made because weighting cannot be placed with a high degree of accuracy. The meaning of the figures is this: Silk in the gum or griege represents 16 ounces or par. The boil off removes the gum, dirt, throwster's oil and soap and leaves us 11 or 12 ounces of clean silk. The weighting figures denote that the original pound has to be brought back to that weight, thus 16/18 weighting is just about par and 20/22 is really 25% over par. Piece dyers use the percentage terms but skein dyers still specify ounces.

Weighting, in theory, is simple but requires much watchful care, mostly of the apparently unimportant details. Anhydrous stannic chloride is reduced in cold water to a 55 or 60° Be. liquid which is further cut, as needed, to 28° Be. Silk immersed in this for one hour absorbs a definite amount; washing with

water converts it first into oxychloride and finally to stannic acid, which is then treated with hot di-sodium-phosphate to eliminate all acidity and convert it to tin phosphate. The first passage takes up a smaller amount and each succeeding passage a larger amount and finally a treatment with silicate of soda will almost double the weight again, besides giving a full brilliant crisp appearance. I have made photo-micrographs of heavily weighted silk fibers, compared with the ash of the same fibers, after burning in a crucible until all organic matter was gone, and it was impossible to tell which was the silk and which was the ash. The tin weighting occupies the entire substance of the fibers, and is not to be regarded as a coating or plating on the surface. When properly done, there are no acid products left to destroy the fiber and any lack of wearing quality is due to the physical alteration, principally to loss of flexibility and elasticity and not to chemical deterioration; unless other chemical substances come in contact with silk that has been weighted.

Weighted silk is dyed in the same way as pure dye, but it is to be noted that inequalities in the weighting are shown plainly when direct cotton colors are used, but when basic dyes or neutral dyeing acid dyes are used, level shades may be obtained.

Black Dyeing

A combination of coloring and weighting is found in black dyeing. In making blacks there is used a solution of basic ferric sulphate, known as red iron liquor. This is absorbed the same as tin chloride and is decomposed into a more basic and insoluble form by washing and then deprived entirely of its acid by a hot soap bath. Then by logwood extract and gambier there is built up a heavy iron-tannin compound which is improved in shade by the use of hematine and pyrolignite of iron (impure acetate or black iron liquor). Some dyers use ferrocyanide of potash to add the color and weight of Prussian Blue to the material. There are many processes in use but the final result is a full black that has advanced the weight of the silk tremendously and whose shade has never been matched by any simple dyestuff.

After dyeing either pure dye or weighted silk the dyer pulls the plug on the box, calls out: "Shoes up" and the highly colored dye bath gushes over the floor. Silk dyers never exhaust a dye bath and never have a very definite idea of just how much dye they have used on a lot. The silk is now full of oleic and stearic acids and oil from the broken soap bath, but it must have more, so a finishing bath, the avivage, is prepared. Into a copper bowl they put an ounce or two of olive oil and pour over it some strong sulphuric acid. It darkens and sometimes smells of sulphur dioxide; this is shaken around and the incompletely sulphonated olive oil is poured into the brightening bath, in which the silk gets a few turns, then is headed up and extracted or whizzed and sent to the dryer. After drying it goes to the finishers who stretch, twist and straighten the skeins, which now have a high luster and feel crisp and full of scroop.

Modern Piece Dyeing

Piece dyeing belongs to the last ten years and the methods are quite up to date. The boil off is done either by hanging the folded pieces on strings in the boil-off bath (which may consist of soluble oils and silicate or other available degumming agents because the gum soap is not saved), run over a hand reel or by special machines. In machine boil off only the foam of boiling soap touches the goods. Other processes use weak caustic and Protectol or waste sulphite-cellulose liquor, but this is not a good process for a careless or nervous dyer. In any case it is very necessary to remove the last traces of soap or lime soap from the goods before attempting to dye them as every trace of foreign matter is likely to result in imperfections in the finished piece, especially in the case of weighted goods. It is hardly necessary to point the advantages of some kind of water softening system.

The chemical principles of piece weighting are the same as with skeins, but the success of the operation depends greatly on the mechanical equipment. Weighting emphasizes every defect in weaving and irregularity in the yarn, and the plants which are equipped to weight goods open at full width have an advantage over those who must run their goods in rope form.

Very few piece dyers to-day use the ordinary acid dyes on either pure dye or weighted goods, they prefer a neutral or slightly alkaline bath or the class of acid dyes which give the equivalent of chrome mordanted colors in one bath.

The better direct cotton dyes and neutral dyeing acid colors will dye fast to hand washing in a neutral bath, but when dyed in soap, soluble oil or phosphate of soda their fastness to washing is not only improved but the goods are less likely to chafe during the dyeing operation. There are available very fast acid dyes which have chromium in their composition and which yield in one simple operation shades excelled only by the vat dyes in fastness to light and washing.

The neutral dyeing colors are obtained from several classes of dyes and may be used to make the

whole range of shades in the standard sample card fast to soaping at 140° for five minutes.

Blacks are made with acid or direct blacks on crepes, but soft fabrics, like charmeuse, are dyed with logwood on a wheel, where the fabric is kept at full width and wound spirally over removable metal rods. This Logwood Black differs from that used on skeins in that the mordant is made with copperas, bluestone and fustic extract, and the dyeing is done with a fairly well oxidized hematine, after which it is well soaped.

While the finishing of silk pieces is not an affair of the dyer, it is often a matter of much concern to him. The goods should leave the dyehouse in an acid condition or scrooped in order that they will have a good hand after they are finished, hence he must keep a bowl of weak acid in which to dip each sample he takes, and the lot must have a final rinse in acid. In this case tartaric, citric and lactic acids are used even in preference to acetic or formic, as they are non-volatile and the scroop is not lost in the dryer.

The finishes are made of gelatine, dextrine, gums and oils in endless combinations. Very little is needed on weighted goods, but on pure dye there is often an effort to get the same weight and hand as on weighted goods, so they are loaded with foreign matter to such an extent that they readily show marks from handling. No adjustment of boil off or dye bath will correct such a condition, although the matter is a constant source of argument with the dyers.

Hosiery Dyeing Methods

To cover the subject of silk hosiery dyeing would take more time than we have at our disposal, so it may be simply mentioned that to-day use is made of the neutral dyeing colors to make the shade on the silk and cotton colors, that do not stain silk, to cover what cotton may be present. Some dyers prefer union colors dyeing both fibers, but the present tendency is away from these. Some dyers boil off first and dye afterwards, while others use a one-bath process and boil off and dye at the same time. Either rotary or paddle machines are used. There are still some all-silk stockings dip-dyed; that is, suspended on strings from sticks in a dye bath and dyed in a broken soap bath like skein silk.

Of course, it has been impossible to go into more detail in this general outline of the subject, but if there are any particular points that need amplification they may be brought up in the discussion that follows the reading of this paper.

Discussion of Silk Dyeing

Chairman Knowland—Are there any questions you would like to ask Dr. Pierce? I am sure he will be only too glad to answer any questions you may care to ask. Mr. Wood, don't you want to ask some?

P. J. Wood—I should like to make a few comments, if I may.

I noticed Dr. Pierce said that some dyers use red oil soap instead of olive oil soap. So far as our experience has gone, we have found that olive oil soap is preferable, because no matter how much you wash goods which have been boiled off with red oil soap there sometimes develops later an odor from the decomposition of the oleic acid which doesn't occur in the case of goods which have been boiled off with green oil.

Dr. Pierce made a reference to the rule-of-thumb dyer, which rather amused me. I have yet to see a silk dyer who uses any other method. We have one cotton-silk dyer who does work on percentage, and I think he is quite unique. I never heard of another like him. Our all-silk dyer is, however, very skilful in handling his rule-of-thumb method. I remember on one occasion I said to him, "Don't you think it would be well if you weighed your dyestuff and kept a record of it? Then, the next time you could reproduce your shade without any difficulty."

He said, "I don't know." He doesn't speak English; we talk to him in Italian.

I said, "Well, I will tell you what we will do: I will make out a receipt for this particular lot of fifty pieces; I will write it down and then as you measure out your colors, the way you do, with a big spool, I will have them weighed up."

I had a very accurate scale in the office and I wrote down what I thought would give the color, having referred to some color cards we made up in the laboratory, and I was surprised to find that his mixture that he made up almost exactly coincided with the receipt that I had written down. When he finished dyeing it, when he got what he called his "first drop," that is, took his first sample off, I said, "I think that will be all right if you will go on boiling it."

He said, "No, I don't think it is quite right yet."

It was a Navy, and I remember the receipt I put down was Direct Blue RW and Sky Blue, certain proportions —I forget the proportions now. When he had completed this first boil, he took a pinch of black and a pinch of violet and a little speck of yellow and put those in and when he boiled it up the next time it was right. Why he had to put that little bit of what I call dirt into it, I can't imagine, but it was absolutely matched. He had to salt it in some way. He wasn't satisfied to let it go at two simple dyestuffs. (Laughter.)

Dr. Pierce—You are speaking of piece dyeing?

Mr. Wood—Yes, entirely, because I am a piece dyer only.

Dr. Pierce—In that case, I never saw a skein dyer who was willing to do more than about one-third or one-half exhaust his bath. He may have plenty of color in there to complete his shade, if he will only work it longer. It is very good for the dyestuff business the way they do it. (Laughter.)

Mr. Wood—Then there was one other thing you mentioned that I wanted to comment on. That was with reference to the acidification of the goods before they went to the finisher. Of course, all our dyeing is done for printing, and we used to acidify just because the dyer was used to acidifying, and for no other reason. This may be news to some of you. On the other hand, maybe you know all about it. We thought we found a tendency on the part of the hydrosulphite not to discharge some of the colors quite so well. We experimented in removing the goods from the liquor, just washing them neutral, and since that time we have had very much better results However, they are dyed with a slight addition of acetic acid to exhaust the bath, and then washed thoroughly, and dried neutral.

Vat Dyeing Silk Yarn

Chairman Knowland—Are there any further questions?

P. H. Stott—I wonder if Dr. Pierce has anything to tell us about the dyeing of vat dyes on silk yarn. That is a problem, of course, that is increasing in importance. This is what I had in mind: that I should like to ask Dr. Pierce definitely if he has attempted to degum and dye silk with vat colors at the same time by using any solvent other than soap for the silk gum? My idea of the thing is that possibly silk gum could be used in the dye bath as a protective medium for the silk against the alkali, which it is necessary to use in dyeing vat colors.

That is just an idea. I don't know whether you have had any experience with it.

Dr. Pierce—In order to dye vat dyes successfully on silk, you must use the class of dyes that require the minimum amount of caustic. If you attempt to protect the silk from the action of the caustic by the addition of sulphite cellulose liquor, you also retard the dyeing operation. The more you put in, the slower it dyes; and when you get in a fair amount you find that you can't get a satisfactory shade. That is the big objection to it. If you put in enough caustic and a material like Protectol, to protect the silk and degum it at the same time, you would have great difficulty in getting your dye to take on the silk. So the only successful dyeing of vats on silk is where your bath has the minimum of alkalinity, and that eliminates some of the vat dyestuffs of the anthraquinone series.

Mr. Stott—Of course, I have done quite a little work on the dyeing of silk with vat colors.

Dr. Pierce—There have been methods worked out. I might mention one method; it may be of interest to you. I believe it was worked out by a man of the Du Pont company. They wanted to utilize their series, and he found that when you had once dissolved the dyestuff you could then add to the bath sodium bicarbonate and neutralize its strong caustic nature and bring it down to normal carbonate, but the dye then was in a colloidal state and it was ready to precipitate inside of an hour or two. If you went right ahead and did your dyeing at once, you could do it. If you allowed the bath to stand very long, the dye would become insoluble and you couldn't get any dyeing done.

Mr. Stott—Yes, of course, the idea of adding bicarbonate to the dye bath has been worked out, I think, quite completely and, in fact, I think I am right when I say that it is being used to-day in a practical way in many mills. But that isn't quite what I had in mind. What I wanted to bring out particularly was whether it would be possible to remove the silk gum and dye it in the same operation by means of some more efficient solvent for the silk gum possibly than the alkali itself.

Dr. Pierce—Silk gum can be removed very readily by caustic soda at 110° F. in the presence of Protectol or sulphite cellulose liquor. You have the conditions there. But when you have sufficient Protectol to take care of the silk, you have so much there that you can't get your dyeing done satisfactorily.

Mr. Stott—It would probably be all right for light shades.

Dr. Pierce—Very light shades might do it.

Herbert Grandage—I should like to ask Dr. Pierce what, in his opinion, is the proportionate loss in strength in dyeing vat colors as compared with others? What should it be?

Dr. Pierce—I have never made a test of that.

Mr. Grandage—Is there anything that can be used that will avoid that loss?

Dr. Pierce—The only thing I can suggest is to keep the alkalinity as low as possible. Use dyestuffs which may be dyed in a bath of low alkalinity.

Mr. Grandage—But under any circumstances, even with that class of dyestuff, there is some loss?

Dr. Pierce—I have never checked it up on a machine. I have never had a machine available for doing it.

Mr. Stott—I think I can answer Mr. Grandage's question.

Two years ago I read a paper at Charlotte which was based on the dyeing of silk with vat colors and at that time we were experimenting with the dyeing of piece goods. It was only experimental, of course. We took tensile strength tests of the silk before and after dyeing

and found practically no loss in tensile strength. However, the concentration of alkali in the dye bath solution (I am speaking from memory) in no case was higher than three-tenths of one per cent.

Chairman Knowland—Are there any further questions?

If there are no further questions I want to say that we are greatly indebted to Dr. Pierce for coming here to-night. In the first place, we had planned a complete program for the evening and, like every other plan, something went wrong. We had expected to have Dr. Wuth with us this evening, but, unfortunately, he could not return to the United States in time and Dr. Pierce very kindly consented this evening to act as a "pinch-hitter." Personally, I owe him a great deal of thanks for coming here to-night, and I think the rest of the members feel the same way.

We will now hear from the Chairman of the Question Box Committee.

The Question Box

Mr. Wood—Here is Question No. 1: "How can I get the shade of Patent Blue on silk imitated with a vat color?"

Chairman Knowland—There ought to be a lot of comment on that, oughtn't there?

Mr. Wood—If anybody is in possession of this valuable secret, I wish they would get up and tell us.

Mr. Grandage—You might add Logwood Black to that.

Peter Fiebiger—How would it do to use Blue GCD and then put it through bleach? (Laughter.)

Chairman Knowland—This is on silk.

Mr. Wood—You couldn't put silk through a chlorine bath, for one thing, and I don't think even then you could approach that brilliancy of color.

Question No. 2: "How can I deluster Celanese? I have tried caustic soda and dyed with direct colors, but still have a luster." (Laughter.)

Mr. Grandage—Wasn't that answered, Mr. Wood, in a paper that was presented here two or three years ago by a man from the Celanese company?

Mr. Wood—I don't think they had it worked out then as they have it to-day.

So far as I recollect, the process is to boil violently with soap containing a certain amount of alkali. I believe the process is entirely mechanical. I don't think there is anything chemical about it. It simply seems to disturb the face of the fiber and produce this matter or lusterless effect. Their celebrated similis effect (the method by which they bring back the luster), is produced by relustering with ammonium sulphocyanide. They originally recommended calcium sulphocyanide, but I think ammonium sulphocyanide is now used.

I think that really answers the question. It is merely a mechanical disturbance of the surface luster of the fiber. I don't believe there is any chemical change that takes place.

Are there any further comments on this question?

The third question: "When discharging direct grounds with vat colors I notice the ground color is more apt to return than when printing the ordinary discharge method for whites."

That is hardly a question. That is more in the nature of a statement. Does anyone feel able and competent to discuss it? Has anyone any remarks to make? We don't do any vat color discharges.

Mr. Stott—Possibly that might be due to the fact that he hasn't enough discharging medium in his vat color printing paste. If he doesn't effect a complete discharge of the direct color ground by lack of hydrosulphite—

Mr. Wood—He doesn't say that the discharge is not as complete. He says the color is more apt to return. It would seem to me that that is more likely to lie with the direct color chosen for dyeing the ground color, because it is a notable fact that several of the direct colors do reoxidize after discharging on standing.

Chairman Knowland—Particularly in alkaline discharge.

Mr. Wood—Yes, that is true.

Would anyone like to comment further on this question?

Mr. Stott—The only way to prove that definitely (I don't know whether the author of the question has done this) would be to take a piece of white cloth and print the vat color on it; take a piece of dyed cloth and discharge it without any color; then take the same piece of cloth, dyed with the same ground color, discharge it with the vat color that was printed on the white cloth, and see whether there is any oxidizing back.

Mr. Wood—In other words, make a white discharge and a color discharge on the same fabric.

Mr. Stott—On a piece of white cloth, so they will have the original color of the vat on the white cloth.

I don't know whether that has been done or not.

Mr. Wood—Whoever propounded that question will see the answer in the report, I presume.

Are there any further remarks on this question?

The fourth question: (This is rather an abstract one and might provoke a great deal of discussion.) "As a chemist, what benefit would I receive from the proposed research laboratory, assuming I was as competent as a chemist they might employ?"

The question isn't very clear. If the inquirer of the question would clarify it a little, I am sure we would be much obliged.

Mr. Stott—I think that what the author of the question

intends to imply is that, assuming that the laboratory of the Association were established and put in charge of a man equally as competent as this hypothetical individual, what benefit could the latter obtain by collaborating with the chemist of equal academic standing and knowledge? I should say a good deal of advantage, because two heads are always better than one.

Mr. Grandage—It doesn't seem to me that the chemist selected for regulation of the affairs of this laboratory is going to have so much bearing on the benefits you get from it as the laboratory itself and the pooling of the information that will be contributed there with the activities of the Association. The ability of the man himself does not matter so much as the work that is laid out for him and the procedure as laid out, I presume, by our Council and Research Committee.

Mr. Wood—Are there any further remarks?

Mr. Hoagland—Possibly the author of the question is a consulting chemist, who wonders if the laboratory will be set up in competition with him.

Mr. Wood—The question doesn't read that way.

I don't see how the laboratory will compete with the regular commercial laboratory. It would seem that the function of the laboratory, the Association's laboratory, would be more academic. In other words, they would take up research of general interest rather than of particular interest, that is, personal problems in particular mills. On the other hand, there is no reason why those personal problems shouldn't be put before the Association's laboratory.

Mr. Grandage—Mr. Wood, this hasn't any direct bearing on the question, but I should like to ask, what has the Council's plan been for the laboratory? In other words, how have they planned to regulate the affairs of the laboratory? It isn't the intention, is it, that the man we hire to run the laboratory shall direct the affairs of the laboratory? It is an Association matter, isn't it?

Mr. Wood—Yes. It will be run by the Research Committee, without a doubt, and the work will be laid out by them. Of course, all those details have to be worked out in the future. As a matter of fact, the plans are in a nebulous state at the present time, as they must be, of necessity.

Mr. Grandage—Don't you think that that partially answers this question? It seems that whoever asked that question feels that the chemist who is employed for that laboratory will be the motivating spirit behind it. I don't think that is intended at all.

Chairman Knowland—The Association is to be the motivating spirit behind it.

Mr. Wood—Quite so.

Are there any further questions or answers? If not, we will close the Question Box.

Chairman Knowland—Are there any questions anyone would like to ask that haven't been covered by these particular questions?

Louis S. Zisman—Mr. Chairman, I should like to ask this question: How can the natural yellow silk, commonly known as Italian silk, be bleached white, or what can be done to make it white? Can anybody here answer that?

Chairman Knowland—Can you answer that, Mr. Wood?

Mr. Wood—Italian silk is very yellow when it comes to us in its natural state, but as compared with yellow Japan silk, I think you will find that even after boil off it is very much clearer and, incidentally, it has a greater boil off. I don't know the exact figures, but we will assume that the average boil off of China and Japan might be about 20 per cent. Italian silk would run 23 to 25 per cent.

Mr. Zisman—When it is in combination with cotton, is there any further trouble?

Mr. Wood—I don't see why there should be.

Mr. Zisman—I haven't tried this, but would the natural yellow coloring matter which apparently comes out in the boil off stain cotton to an extent that would prevent it from being a good white in the same bleach, assuming you used peroxide, let us say?

Mr. Wood—I can't answer that question. I think a little experiment would demonstrate that, by taking a skein of white cotton and trying to dye it in a boil-off liquor in which Italian silk had been boiled off. That would show you just what color it would assume from the yellow liquor.

Mr. Zisman—I think that is probably where most of the trouble is.

Mr. Wood—I would sugest that you make that experiment, Mr. Zisman.

Chairman Knowland—Are there any further questions?

Dr. Pierce—The coloring matter of yellow silk is mainly in the gum. It is a very peculiar thing, but if you take silk worms from a certain district that have been producing white silk and move them over into another district where they have been producing yellow silk, in two generations they will produce yellow silk. And if you take worms that have been producing yellow silk and put them in a district where they make white silk, in two generations they will produce white silk.

Going back to Mr. Zisman's question, in bleaching cotton and silk hosiery, the boil off and bleach in one operation, with peroxide, in the presence of soluble oil, I have seen nine lots come out perfectly white; on the tenth lot, the silk turned yellow before the cotton was bleached.

We hunted in vain for an answer to that problem. The nearest we ever came to it was that the yellowness was due to the presence of iron that got in somewhere and

not due to anything in the silk. It was not yellow gum silk, because the mill didn't use any yellow gum silk in making up the hosiery. But we occasionally struck a lot that wouldn't bleach white and never found the answer to it.

Chairman Knowland—Are there any further questions? If not, I think we ought to give Dr. Pierce a rising vote of thanks for coming here this evening. (Applause.)

. . . The meeting adjourned at nine twenty-five o'clock.

COMMUNICATION

NEOMERPIN AS AN ACCELERATOR IN THE USE OF DIASTASIC ENZYMES

THE claim has been made that various European works have during the last year or so employed Neomerpin N as an accelerator in connection with diastasic enzymes used in desizing operations. Inasmuch as Neomerpin N is strongly acid in character, I was of the opinion that there must be some mistake about these claims, because it is a perfectly logical assumption that the strongly acidic character of Neomerpin N would tend to destroy all enzymatic activity. In an attempt to determine exactly what would be the effect of its use in connection with desizing, a series of experiments have been conducted and these led immediately to a confirmation of the suspicion that the acidic character of Neomerpin N does destroy all enzymatic activity. In fact, using as little as 1 ounce of Neomerpin N for 100 gallons of liquor, the starch reduction was less than 2 per cent, and in view of this result no more detailed investigation was attempted with the acidic product.

Further tests were made, however, with Neomerpin SA Conc. Powder, which is a neutral product, and in this case it was found that the chemical exerted its usual powers of penetration and as a result gave greater surface area for conversion and did increase enzymatic activity.

From the results obtained there appears to be no progressive acceleration of enzymatic activity, as the maximum effect is when using 2 ounces Neomerpin SA per 100 gallons. Any variation to either side nullifies the effect. Less than 2 ounces produces no apparent reaction at all, while more actually inhibits enzymatic action. In addition, a precipitation occurs when more than 2 ounces are used. This precipitation becomes more pronounced as the concentration of Neomerpin increases.

The experimental results are given in the following table:

QUANTITY PER 100 GALLONS

	Maltogen (lbs.)	Neomerpin SA (lbs.)	Temp. (° F.)	Time (hrs.)	% Loss as Starch
(1)	25	None	130	2	9.6
(2)	25	1/4	130	2	8.8
(3)	25	1/8	130	2	10.2
(1)A	25	None	130	2	6.1
(2)A	25	1/8	130	2	10.6
(3)A	25	1/16	130	2	7.6
(4)A	25	1/32	130	2	6.8
(1)B	25	None	130	1	6.4
(2)B	25	None	130	2	6.8
(3)B	25	1/8	130	1	8.0
(4)B	25	1/8	130	2	9.8

That the optimum point should be so finely defined might cause some skepticism as to the accuracy of the experiment, but repeated tests have shown that the above conclusion is reliable.

A starch iodine test using the maltogenic products as conversion products to determine relative conversion and attack on starches proved to be rather indistinct as to definite color reactions. They did, however, show that with malt liquors containing upward of 4 ounces Neomerpin SA per 100 gallons little or no color change was noticed, but with 2 ounces per 100 gallons the color changes were more pronounced with descending rapidity of action, and with ½ ounces per 100 gallons the color change approaches that of malt alone, showing that, with this, starch conversion was of about the same activity. This test was made merely to serve as comparison and could not be termed accurate from a quantitative standpoint.

A. T. HARKINS,
Newport Chemical Works, Inc.

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The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

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AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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ALL SET FOR TARIFF REVISION

THE time is at hand when textile mill owners and dye manufacturers can keep only one eye on their business, because the other must be turned upon Washington, where Congress has just opened its short session. Despite its brevity, the session will probably be of deep significance to our industry, because it has revived again the issue of tariff revision.

Six years now the Fordney-McCumber tariff has been in operation, and during the past three the opinion has been steadily gaining strength that changes in many schedules are needed. The issue is not a pleasant one to thrash out at any time, we admit, much less now, when paens of praise are being sung upon our national prosperity. For when a nation is suffused with the contentment that comes of wealth and peace and comfort, it would be no more than natural for that nation's business men to brush aside such an aggravating issue as tariff revision with the hoary excuse, "Leave well enough alone."

But it has been growing evident that the tariff has not been "well enough" in the view of many, or the air would not now be charged with sentiment for and against revision. The only sensible attitude for industry in general to assume, therefore, should be one of patience in facing the facts and sound judgment in making any tariff changes called for by those facts.

Why attempt to deny, after all, that the boon of prosperity so heartily sung in some quarters has not fallen to the lot of every factory, plant and mill in the country? Why not admit that certain industries are plainly not as content as our general condition would seem to warrant? And why not try to realize, those who grow impatient over this annoying issue of tariff revision, that discontented industrialists are almost certain to blame the tariff for their unprosperous state? The fact must be accepted, therefore, that parts of our tariff act will be changed, most likely before another year has passed; and that, so far as we are concerned, the changes may profoundly affect textiles and dyes.

Scarcely a month ago it was confidently asserted by some authorities that no action on the tariff should be expected in the Congress which convened last Monday. In fact, it was declared that any attempt to force this big issue in the short session would be the height of folly and a wanton waste of time. But those who spoke thusly admitted wisely that some preparation for tackling the tariff question should be made at this time. Industry was advised to dust its tariff-committee tables and to gather around them for earnest discussion of its tariff problems.

The advice was put into action by a group of manufacturers who met two weeks ago in New York at a conference called by John E. Edgerton. Mr. Edgerton, president of the National Association of Manufacturers, told these men, who represented a score of industries, just why they had gathered. He declared that reports had predicted an attack on the tariff in the present session of Congress, and also reminded his audience that insistent demands had been made for a special session of Congress, after Hoover's inauguration, to consider specific tariff revisions both downward and upward. Surely, reason enough for a conference!

Now, a resolution which these industrial leaders passed at their meeting called for a committee to answer the question, "Whether the country needs a new and modern form of tariff administration, just what form this should take and just how it should be applied?" That is interesting. It implies, for one thing, that these business men are dissatisfied with the present Tariff Commission's system of handling adjustments. What they want is a more effective tariff machinery that will operate without any relation to politics. They want a non-partisan body appointed for the adjustment of tariff rates. In short, they want to put the tariff on a business basis.

Can no one imagine a tariff divorced from politics? There is no sensible reason why such a phenomenon cannot be created by intelligent co-operation of this nation's farmers and manufacturers with the Government. However, such a proposal may float about for a long time before some super-intelligent tariff expert is able to transform it into an active policy. Meanwhile things are happening already in that session of Congress which opened last week. The way has been paved for the preliminary steps toward a revision of the tariff that many believe will be enacted in a special session next spring. Hearings for the purpose of obtaining the information necessary for the effective readjustment of tariff rates were actually approved last Tuesday by the Ways and Means Committee, and those hearings will open January 7.

Furthermore, the first three days' hearings before

this committee will concern chemical products, including, most likely, dyestuffs. Later sessions scheduled for the last days of January and the first weeks of February will deal with cotton, wool and silk, and their manufactures.

As to the schedules on coal-tar dyes, there is no need to explain their status here in detail; their history is well known to those who watched our dye industry's struggle for protection in that crucial period just prior to the enactment of the Fordney tariff. It will be recalled that the original rate on finished coal-tar products was fixed at 60 per cent ad valorem and 7 cents per pound, and that, according to a special provision, the ad valorem duty automatically dropped to 45 per cent three years ago.

During the hearings before the Ways and Means Committee it may possibly be argued that, even with the lower rate in force, certain classes of colors are more than adequately covered; and some rash, uninformed person might insist upon blanket reductions. But, on the other hand, it cannot be denied that some classes of dyes now manufactured in the United States, such as the vat colors, must not be thoughtlessly subjected to any greater competition from imported types. The vats alone form a group far too essential to the industry's well-being to expose them to any unfair discrimination. The faster and in some cases more costly types of dyes have immeasurably aided our textile industry to solve one of the most amazing merchandising problems it has ever faced—the problem of satisfying an unprecedented public demand for fast-color fabrics. Nor should it be lightly assumed by anyone that colors of this class and others are fully covered by the provisions of our present tariff. The dye import figures for the past few years have indicated clearly that the weight of the competition lies in those higher grade colors.

The question of making the tariff more effective by readjustment is, we repeat, not a pleasing one to ponder. But those industries which have not bathed in the glare of national prosperity may rightly demand some attention at the Congressional tariff hearings in January. The farm-relief protectionists may make an effort there to dominate the floor; in that case the industrial groups must be well prepared to fight strenuously for their own interests, to which the farmer's welfare is, after all, closely related.

Moreover, not only should industry be informed as to the specific reasons for revising certain tariff schedules; each industry must make absolutely sure that those who speak for its interests before the Ways and Means Committee are also well informed. It is far better to prepare earnestly only to lose in the end, than to dodge the issue of tariff revision meekly because it is a disturbing issue. If the domestic dye industry really wants more efficient protection, then it is plainly the duty of our manufacturers to guard carefully against defeat by posting their representatives on every specific argument for stronger dyestuff duties. Is the importance of an independent American dyestuff industry not just as great to-day as ten years ago?

INDUSTRIES SIMPLIFY TO FIGHT WASTE

Wide Acceptance of Standards Reported

SIMPLIFIED PRACTICE, or the elimination of waste in industry through simplification, gained 1,705 supporters during the third quarter of 1928, Ray M. Hudson, Assistant Director of the Bureau of Standards, in charge of the Commercial Standards Group, brings out this encouraging fact in his report to the director covering the work of the Commercial Standards Group for the period ending September 30, 1928.

"Furthermore," Mr. Hudson states, "at the end of the second quarter of this year (June 30), there were 9,754 individual firms and 883 trade associations supporting simplified practice recommendations. At the end of the third quarter (September 30), there were 11,319 individuals and 1,023 trade associations. This indorsement is given in the form of a signed acceptance to each simplification project, by which the acceptor pledges his support to the program as developed by the industry."

Commenting on this gain in acceptors, Mr. Hudson said, it was apparent that the consumers were becoming better acquainted with the benefits that result from buying the simplified or standard lines. The simplified line not only gives purchasers better values in the form of improved quality of product, and cheaper prices, but it makes delivery and replacement a simple problem, since the manufacturers can produce for stock, thus insuring a sufficient supply of the commodity will be on hand with the merchants and jobbers.

"Due to the vacation period in industry, only one new recommendation was completed during the summer, making a total of 96 simplifications effected to date. Of this number 87 have been accepted in writing by the respective industries and are in effect, with 79 being available in printed form. During the quarter ten new simplification proposals were submitted by industry to the Division of Simplified Practice for study."

DYES FOR RUBBER NEEDED IN BRAZIL

A firm of exporters and washers of rubber in Para, Brazil, importing on its own account, has expressed a desire to the American Consulate at Para to purchase chemical dyes to be used in the manufacture of rubber crepe. Samples of rubber crepe have been submitted, and properly accredited American firms who are interested in this opportunity may obtain the name of the inquirer by addressing the Chemical Division, Bureau of Foreign and Domestic Commerce.

EXTRACTORIALS

How can research be done by the small manufacturer? Numerous ways are open to the manufacturer who does not feel that he can set up his own laboratory. Several universities and engineering schools are ready to do such work for a nominal fee. A few reliable commercial laboratories will undertake the study of definite problems. A single word of caution may help the manufacturer who is just starting research work: Do not expect results too quickly.—*Manufacturing Industries.*

Any well-established and successful chemical industry to-day could disband its research and development departments entirely and probably show no ill effects in its profit and loss statement for three or five years. The momentum carries the business along for a while, but soon the curve begins to descend, at first slowly, then with increasing speed until some day the announcement comes that what is left has been taken over by a more progressive concern.—*John E. Teeple, in Industrial and Engineering Chemistry.*

The first need of the mill is modern equipment. Then good management and named fabrics. Sensible advertising in magazines and newspapers of general circulation is the next step, always backed by a product up to the original standard.—*Fibre and Fabric.*

The view has been recently expressed that amalgamations will deal a serious blow to scientific and industrial research, but a careful consideration of the history and present position of such trade associations indicates that this view is wrong. It assumes that the unification of productive facilities will reduce or eliminate internal competition, and thereby enable profits to be maintained from mediocre quality of products; there being absent the stimulus of competition which previously has made for progressive quality. In some of the earliest combinations this may have been the attitude, but it is an attitude that events have quickly dispelled.—*Manchester Guardian Commercial.*

There is no reason why physical chemistry should be more theoretical than any other branch of chemistry; it is, indeed, the most material branch. Only as physical manifestations are apparent does chemical behavior become important. The greatest progress in applied chemistry to-day is coming from the study of physical chemistry. The textile chemist as a worker in one branch of applied chemistry can, least of all, afford to neglect physical chemistry.—*Alan A. Claflin.*

DYE IMPORTS FOR OCTOBER SHOW HEAVY INCREASE

Total Poundage of Foreign Dyes Second Only to April Figure

ACCORDING to the monthly report on imports of synthetic dyes issued by the Department of Commerce in collaboration with the Chemical Division of the United States Tariff Commission, the total imports for the month of October amounted to 608,852 pounds, valued at $501,601. This was an increase of about 350,500 pounds over the imports for the preceding month and was the second highest total recorded so far this year, April imports leading as the table below indicates:

Imports of Synthetic Dyes

	1928, 10 months		1927, 10 months	
	Pounds	Invoice Value	Pounds	Invoice Value
January	415,156	$327,148	196,620	$186 387
February ...	478,407	391,351	312,277	262.364
March	378,191	316,193	404,714	352,414
April	633,815	505,152	402,783	323,732
May	382,233	295,969	349,476	265.752
June	411,662	309,607	318,450	253,054
July	424,613	334,849	263,162	214,853
August	389,957	317,879	401,122	339,269
September ..	257,295	240,132	396,432	325,338
October	608,852	501,601	417,626	313,122
Total	4,380,181	$3,539,871	3,462,662	$2,836,285

Per Cent of Dyes by Country of Shipment

	Oct., 1928	Oct., 1927	Jan.-Oct., 1928	Jan.-Oct., 1927
Germany ...	64.10	61.00	64.03	57.63
Switzerland .	27.25	27.00	25.24	25.78
France	0.80	2.00	1.51	3.02
England	1.50	1.00	1.96	4.02
Belgium	1.70	4.00	2.58	4.93
Canada	3.60	0.50	2.56	2.40
Italy	0.55	4.00	1.51	2 09
Netherlands .	0.50	.50	0.61	0.13

Remaining in Bonded Customs Warehouse

	Pounds	
	Dyes and Colors	Intermediates
January 31, 1928.....	609,573	818.695
February 29, 1928....	636,566	1,291,636
March 31, 1928.....	716,032	1,264,965
April 30, 1928.....	740,239	506,337
May 31, 1928.....	778,670	1,873,016
June 30, 1928.....	837,955	2,122,049
July 31, 1928.....	749,744	2,368,616
August 31, 1928.....	707,820	2,584,244

The Dyer's School of Experience

[EDITOR'S NOTE.—*The following narrative is one of a series being published under the general head of "The Dyer's School of Experience." Realizing that the genuine material for such a series is to be found largely among its own readers, The* REPORTER *solicits contributions from that source and will pay for those accepted at regular space rates. Among the readers of this journal there should be many who have, in the course of their experience as dyers or chemists, encountered incidents which should prove most interesting and helpful to their fellows. Send all manuscripts to* AMERICAN DYESTUFF REPORTER, *90 William Street, New York City.*]

SPOKEN OUT OF TURN

By I. V. SHEFFIELD
United States Finishing Company, Cedartown, Ga.

WHEN I stack my seven years' dyeing experience against that of those who have been in the game for thirty or thirty-five years I feel the truth of that old saying of our grandmothers that "Little boys should be seen and not heard."

However, if my shining example of unmitigated gall will stimulate some response through these columns from the old-timers, I will feel that my task has been accomplished, which was that of backing Noel White in his appeal for material for this department.

It has been a great pleasure and a greater profit to me to have been associated with several of the dyers of the old school; one in particular furnished me with a good laugh. This happened several years ago when I was doing finishing work and had nothing to do with the dyes.

This dyer, who shall be nameless for several reasons, was one of the suspicious kind. He kept all his formulae hid, and if anything went wrong with his shade he was ready to suspect anyone but himself. He was doing sulphur dyes on piece goods with a continuous machine, and on this morning he got his shade with little or no trouble and started up on his run. After about five thousand yards had run over, the plaiter boy called him and showed him some spots that were occuring with increasing regularity. They had the appearance of being wax of some kind, and after stopping the machine he found large globules of wax floating around on the surface of his dye bath.

After seeing the wax on his dye liquor, the dyer proceeded to go through the roof. Some son of a blankety blank had put wax in his machine to make him spoil a lot of cloth. He would fire every man he had and not turn another wheel until he had a new crew. He didn't understand what made him come down to this damnable hot country in the South, anyway, he'd be a blankety blank if he wasn't going back to New England. He headed for the drug room and found two cakes of paraffine wax missing from a carton of a recent shipment. This seemed to confirm his suspicions, and he was literally frothing at the month when he sent for the manager and placed his case before him.

The dyer was so thoroughly convinced that he had nailed the trouble that he had no difficulty in making the manager believe his story. However, about this time the manager's brother came through the mill, and after being told the trouble and the solution started laughing. Much to the chagrin of the dyer he stated that he had taken the two cakes of wax home the day previous for his wife to use in sealing some jelly.

While all the talking was going on the office boy brought in a salesman to see the manager. The salesman, a competent technical man, had no difficulty in demonstrating that the wax was being extracted from the warp size of the cloth by the hot alkaline dye bath.

Perhaps it is not necessary for me to remark that this dyer was back in New England in a very short time.

THE USEFUL THERMOMETER

At another place where I was associated with an old-timer I learned the importance of the use of a thermometer in dyeing, and I think the dyer learned the lesson even better than I did. This dyer was a chemist also, which makes his slip all the more remarkable.

He had designed a continuous machine for light and medium weight cloth, and the company had it built to his specifications. As his mixing tanks were only a few feet from his padder, and his padder box held only about ten gallons, he figured that he would not need a coil in his padder to maintain the proper temperature. However, when the machine was ready to run he couldn't hold his shade for more than a couple of pieces, and no adds or increasing percentages of feeds would help him much.

After about a week of work he finally came to the conclusion that his machine was so light that he would have to give all shades two passes through the liquor that were heavier than hong kong. This made the operation cost him about 75 per cent more, but he couldn't figure out a better plan.

This man was my boss, though I was still doing finishing work at that time. I had done a little studying and had kept my eyes and ears open, consequently I was beginning to have some idea of what it was all about, especially with the class of dyes we were doing. I watched my chance and stuck a thermometer in the dye bath. It registered 160° F. I knew that the best dyeing temperature for those dyes was about 210°, but I didn't dare go to him and tell him that all his trouble was caused by not having a coil in his padder; I had to make him find it out for himself. He was always good at answering questions of mine, so I asked him what was the proper dyeing temperature of the dyes he was using. He an-

swered me that it was from 200 to 212° F. I then asked him how much difference there was in the temperature of the entering and delivery side of his little padder box. He said he didn't know, but just for curiosity we would see. He got a thermometer, stuck it in the dye bath, looked at it, stuck it back for a longer period and looked at it again. He then asked me to lend him my thermometer, as there seemed to be something wrong with his. My thermometer showed the same result, and his face was a study in conflicting emotions. He immediately shut down the machine, sent for the piper and ordered a coil made for the box. That was the end of his troubles so far as maintaining the depth of his shade was concerned.

Shades and a Value

I had this question of temperature brought home to me again after I had become a dyer, and again it was a continuous machine.

My shade would run off very brown, and soon after adding to throw it back to the green side it would come too green, necessitating an add of brown. This cycle kept repeating, and after checking the dye bath, which was controlled by a regulator, and finding it O. K., I began checking the after-treating bath. I found that after setting it at the proper temperature it would not stay at this point for more than ten or fifteen minutes, but would gradually get hotter. I found this to be caused by a steam valve which was loose in the packing gland; the vibration of the machine caused it to slowly open. I immediately asked for, and received, a regulator for this bath also.

Perhaps the sweetest balm to a dyer's heart is something like this:

Several years ago the company for which I was working was headed for the rocks, and I knew that it was only a question of weeks until I would be out of a job. I heard of another small place which was planning to put in the class of work with which I was familiar, and sent in my application. I received a reply from the manager stating that he didn't consider that I had sufficient experience to put in the process and operate it successfully.

Shortly afterward I secured a position with another concern just starting up on the same line, and had no difficulty in giving satisfaction. A few months after we got going I had the pleasure of having a representative of the mill that turned me down call on us and ask for criticism and suggestions as to how they could improve their product. Not feeling any too kindly disposed I left it to the superintendent to do the suggesting while I confined myself to a few criticisms!

Let's have more experiences of the old days, of the old methods, by those who know. I do not count myself among that fortunate number, but I have the temerity to ask a question: How are you doing it to-day compared with twenty years ago, and why?

NEW COLORIMETER MAKES POSSIBLE ACCURATE COLOR DETERMINATION

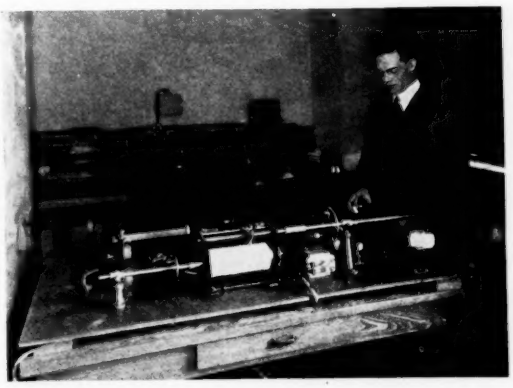
Parisian Shades May Be Duplicated by Radic—Use in Dye Cataloging and Testing

AN instrument that will enable dye experts on this side of the Atlantic to duplicate exactly any of the fashionable shades created by Parisian style dictators by merely working from a photoradiogram of the color analysis has recently been perfected. Its operation was fully described at the annual convention of the Optical Society of America at Washington on November 1 by the inventor, Prof. Arthur C. Hardy of the Massachusetts Institute of Technology. The instrument will obviously be of use in solving the color problems of many industries, and should be of particular value in standardizing dyes or colors on fabrics, or in testing fastness, where accurate determination of the shade is so essential.

This new color analyzer, known as a recording spectrophotometer, eliminates human judgment entirely, it is declared, and automatically measures the color and wavelengths of any substance rapidly and with precision. Not only does it measure color accurately, but it makes a record by which it is possible to match that shade at any time, thus eliminating all possibility of fading of a standard color.

Construction of the Instrument

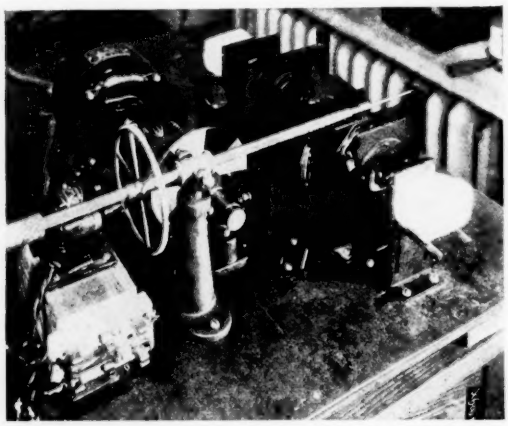
Odinary white light, or sunlight, if passed through a triangular glass prism, is broken up into rays of various wavelengths and colors, varying from deep red at one end of the spectrum through orange, yellow, green and blue to deep violet at the other end—just as rain drops break up white sunlight to form the same succession of colors in a rainbow. Similarly, if colored light is passed through a triangular prism it is broken up into bands of



different wavelengths and colors, with some colors more prominent than others. Colors as we know them are not pure colors of a single wavelength, but are mixtures of various wavelengths. The prism, for instance, will sho that a sample of green dye might contain a little of every

color, a decided proportion of red, and a maximum of bluish green, green and yellowish green.

The new spectrophotometer, a combination of a powerful optical system and electrical devices, analyzes the spectrum of colors and makes a chart of the analysis. The specimen color to be analyzed is placed in a holder and



Details of the Hardy Colorimeter

illuminated by a special ribbon-filament incandescent lamp. Magnesium carbonate, the whitest substance known, is used as the standard of comparison in the laboratory instrument. Light is alternately reflected from the specimen and the magnesium carbonate, and acts upon a photoelectric cell in which it sets up an alternating current.

This current is fed to a vacuum tube amplifier which increases the power 10,000,000,000 times. The color of the specimen is analyzed at each wavelength of the light spectrum, and the record is made automatically by a pen moving over a revolving drum. The result is a description of the color, by means of which the identical shade may be reproduced as often as desired.

The light from the incandescent lamp falls perpendicularly on both the specimen and the magnesium carbonate standard and, after reflection from the specimen and standard, enters the slit of an ordinary spectrograph system.

Immediately in front of the slit is a rotating glass disk having alternate silvered and transparent segments. The disk is so located that light from the standard enters the slit when a transparent segment is in the beam, and light from the specimen when a silvered segment is in the beam. The spectrograph system disperses the light and a second slit selects the proper wavelength band. Light passing through the second slit falls on a photoelectric cell which receives monochromatic, or single wavelength, light of pulsating intensity when the standard and specimen reflect different amounts of light in the spectral region.

This pulsating light intensity is changed to a pulsating current by the photoelectric cell, is amplified, and is then employed to run a small motor. This motor actuates a shutter in the beam between the light source and the standard, and automatically finds a position where the pulsations of the light cease. This position is independent of the characteristics of the photoelectric cell. A pen is attached to the mechanism controlling the shutter to record the reflecting power of the specimen on the rotating drum. A second motor rotates the drum and at the same time drives the slit across the spectrum, thus giving a complete color analysis in a time which has recently been reduced to less than a minute. In other words, a color analysis now takes no longer than is required for the measurement of some of the simplest of physical properties.

Commercial development is being carried on by the General Electric Company, to whom the patent rights have been assigned by Professor Hardy.

Solving Color Problems in Several Industries

The importance of the new color analyzer lies in its value to industry in nearly every branch of which control of the color of its products is necessary. Accurate measurement of colors is the first concern of manufacturers of fabrics, particularly in the delicate shades which often deceive the eye. Color control is also of basic importance in the making of inks, paints, dyes and paper. In fact, there is scarcely an industry without a color problem.

The color of a product usually is neither the most important nor least important property; it is simply one of the properties which many manufacturers attempt to control in order to please either the retailer or the consumer. Some manufacturers cater to an exacting clientele by establishing and maintaining a definite set of color standards. The desirability of a product of uniform color applies in producing such things as soap, lard, flour, butter, oleomargarine, cheese, sugar, syrup, chocolate, glass, automobiles, tile, brick, roofing materials, carpets, rope, hardware, paper, leather cement, linoleum, textiles, cosmetics and many other products.

One of the most important fields of usefulness for the recording spectrophotometer is expected to be in the cataloging of the curves of different dyes, so that new colors with predetermined characteristics can be obtained at any time by the proper mixture of standard dyes already at hand.

COAL TAR PRODUCTION IN ENGLAND AND WALES

According to official statistics from the Department of Commerce the coal-tar industry of England and Wales increased its production more than one-third in 1927 over the 1926 output. In 1927, 1,567,072 tons of tar were distilled in gas and coke-oven works and 432,653 tons of pitch produced, as compared with 1,157,523 tons of tar distilled and 310,634 tons of pitch produced in 1926. There was a decrease in the number of plants, 363 tar distillation works being reported in 1927, as compared with 378 in 1926.

Danger Point Reached in Weighting Silks

Opinions Expressed by Leaders in Silk Manufacturing and Dyeing Trade Concur on Limits

IS there a danger point of overweighting silks imminent in any great volume of spring fabrics being put on the market for 1929?"

The question is pertinent in view of the fact that weighted silks in both plain and print lines seem to be forthcoming in greater volume than heretofore. The trade takes kindly to the cloth with a rich appearance and a "hand" that makes it hang and drape effectively. The incentive to produce desirable silks at moderate prices and meet successfully the keen competition of the season, naturally leads to producing the weighted article that most nearly satisfies all requirements.

It is held by many that the consumer is responsible to a large extent for the highly weighted silks. If proffered a pure dye silk at a small cost, and it is light and thin, she will turn it down in favor of the weighted piece that looks and feels good. She does not question the character of the material, or how long it will wear, so long as it has the fashion element of color, weave, or design. Men in the trade reiterate this situation, while they maintain that comparatively few consider the enduring worth of a fabric. They buy only for the immediate present, with the idea that before the garment will have worn out, another must be bought to answer the changing vogue.

Again, the cutter of silk garments who knows little or nothing about the intrinsic value of a piece of pure dye crepe, or its weighted competitor for price advantage, will take the latter either because he makes a very cheap grade garment, or else he sees a handsome profit.

An instance in point, related to the writer, is that of a maker of silk costumes who selects his material by the weight of one or two full pieces that satisfy him. When his order is filled, any piece which does not weight up to his standard, even though it might contain a higher percentage of pure fiber, will be sent back.

It is maintained by high-grade silk manufacturers and wholesalers that there is decidedly a danger point in producing and putting on the market silks which are too heavily weighted to stand up against conditions of atmosphere, chemical effects of water, cleaning processes, and reasonable wear and tear. While it is within the art and cunning of the dyer and finisher to make a part silk fabric that may look more beautiful to the eyes (of some persons) than a pure dye article approximately the same cost, there is a sentiment gaining strength to work against the overloaded weaves in the interest of integrity and fair play.

If a woman finds that a dress spots or will not clean in the hands of experts, she will try to return it to the store from which it came. Due, quite possibly, to the nature of the "loading," or to insufficient allowance for shrinkage—a very easy defect with weighted silks—a garment made from the too cheap material may be beyond redemption.

There seems to be an effort, particularly with the better grade producers and retailers to encourage a "trading-up," in regard to qualities of silk merchandise which shall at least give reasonable satisfaction. The retailer, if he has erred on profiteering on the questionable or unreliable grades, is certain of come-backs from the affected customer, though the cutter who uses the poor fabrics is harder to track. He may either go out of business, or he may reform and buy better goods.

A. N. Lincoln, of the Belding-Hemingway Silk Company, admitting that there is a danger point to be guarded against in the overweighting of silks, and "it stands to reason that if a thing is 55 per cent silk, and 45 per cent load, it is not as strong as the 100 per cent silk article. Super-weighting is still overdone. With our own products, we shall not go farther with weighting this year than heretofore."

Mr. Lincoln added that the subject is one which will be much discussed, and that trade publications can agitate a move for improvement, which is the hope of the high-grade silk manufacturers.

Paul Bonner, of the Stehli Silks Corporation, said on the subject of overweighted silks, "there is not so much danger of overweighting as that the weighting is not done with due regard to the fabric being treated.

"Scientific weighting," he continued, "tends to make goods that will be satisfactory and overcome faults that have been charged heretofore. Weighting gives body and appearance that unweighted silks can't have." Mr. Bonner added that Stehli silks for spring would be weighted, but with no added per cent of "load" beyond that used in the past.

Mr. Van Riper, of the United Piece Dye Works, while admitting the tendency for many silk producers to weight their silks beyond the safety limit, explained that certain weaves lend themselves to special percentage of weighting due to their nature. A three-thread crepe, he said, could stand from 15 to 20 per cent weighting, and a four-thread 30 per cent. More than that was said to endanger the quality, wear, etc. Plain crepes will take more weighting successfully than the same crepes with print designs. A 45 per cent weighting has been more or less used by producers this season. Some unscrupulous even load to 60 per cent, it is claimed.—*Silk Digest Weekly.*

Harry H. Steidle, of Beechwood Park, Pa., has been appointed as Assistant Chief Business Specialist in the Commercial Standards Unit of the Bureau of Standards, U. S. Department of Commerce, it has been announced by Ray M. Hudson, Assistant Director of the Bureau, in charge of the Commercial Standards Group.

Technical Notes from Foreign Sources

Loss of Strength of Cotton Exposed to Light

P. W. Cunliffe and E. Midgley, Jour. Tex. Inst., T169, 19 (1928).—"It is well known that cotton fabrics exposed to strong sunlight may in time become so weakened that they are unable to bear their own weight. Very little quantitative information has so far been published on this 'tendering' action of light on textiles, and the present paper is an account of the first part of an experimental investigation of the question."

The mercury vapor arc lamps and the ordinary street type of arc lamp were used as light sources, also sunlight. A large number of tables of results (twenty-one) are given, as well as some others in a short appendix to the paper. Work was done on both yarns and hairs under carefully controlled conditions.

Naturally, all material showed progressive loss of strength, more or less regularly. Exposure to light in an atmosphere of oxygen, or of air containing water vapor, increased the loss of strength; exposure in an atmosphere of hydrogen decreased the amount of tendering. The results appear to be those of oxidation, accelerated by moisture, and this explanation is confirmed by the fact that the copper number rose from 0.016 to 1.49. Methylene Blue absorption was affected very little, the exposed cotton possessing, therefore, properties typical of those of the reducing type of oxycellulose. Some curious divergences are evident: for Georgia cotton the separated hairs are about twice as severely tendered as are those composing the yarn, and the mean tendering of the latter is roughly the same as that of the yarn itself; while the Sakel yarn tested and its component hairs are almost equally tendered, for short exposure at least. In general, gray yarns and gray fabrics are not so rapidly tendered as those which have been bleached.

Yarns and fabrics treated with tannic acid followed by tartar emetic were also examined. It was found that exposure to the carbon arc tendered the treated goods much less than the untreated ones; but similar goods exposed to sunlight were more rapidly destroyed than were the untreated. Examination was also made of cotton dyed with basic dyestuffs on a tannin-tartar-emetic bottom. Methylene Blue, Malachite Green, Safranine T and Acridine Orange were the dyestuffs chosen, and goods dyed with them as stated were exposed to the carbon arc, to sunlight (protected from moisture), in Egypt, and to ordinary weathering at Trinidad and at three localities in England. Results were about as before: less tendering under the arc and more tendering under sunlight.

Direct dyestuff dyeings seem to confer a greater power of resistance, the amount of tendering being 0 to 10% for 198 hours of Egyptian and 180 hours of English sunlight; under the carbon arc the loss of strength was 30 to 40% for twelve hours' exposure, against 55% for the undyed goods. Cotton impregnated with ferric hydroxide gains resistance to either arc exposure or weathering, and chromium hydroxide is still more effective in this way.

A short appendix gives certain conclusions as to the effect of structure and of bleaching upon the strength of cotton yarns (seven short tables are added).

Progress Accomplished in Dyeing and Printing

M. A. Wahl, Rev. Gen. des Mat. Col., etc., 1, 32 (1928).—An interesting but general and topical review of the subject.

New Direct Cotton Azo-Dyestuffs

French Patent No. 620,200, *I. G. Farbenindustrie, A.-G.*—By coupling a tetrazotized base of the benzidine series to one molecule of a phenylene-diamine sulphonic acid and to one molecule of 2-amino-8-naphthol-6-sulphonic acid or one of its derivatives substituted in the amino group.

New Acid Azo-Dyestuffs

French Patent No. 626,161, *I. G. Farbenindustrie, A.-G.*—By coupling diazotized aniline to Naphthol AS, which has been previously sulphonated, coupling in the presence of sodium carbonate. A red-orange dyestuff of rather good strength for wool.

Pyrazolone Series Azo-Dyestuffs

French Patent No. 626,652.—By coupling various diazotized amines, as 5-nitro-2-aminophenol, or 5-nitro-4-chlor-2-amino-phenol, to a 2-hydroxy-3-carboxy-5-sulphophenyl-(1)-pyrazolone, which may contain in the pyrazolone ring a methyl, carboxyl or alkyl ester (carboxylic) group.

Also (French Patent No. 626,120) a phenyl-pyrazolonic second component may be used, which contains a methyl, chlorine and sulpho group in the 3-4-6 positions of the phenyl ring, and in the pyrazolone ring a methyl, carboxyl or COOR group.

New Azo-Dyestuffs for Regenerated Cellulose

French Patent No. 625,182, *Baddsley, Chorley and Brightman, and British Dyestuffs Corp., Ltd.*—Dyestuffs for viscose and other regenerated cellulose fibers; prepared from 8-8'-dihydroxy-2-2'-dinaphthylamine-6-6'-disulphonic acid or the 3-6-3'-6'-tetrasulphonic acid as

second component. According to the nature of the diazo component, the coupling may take place in mineral or organic acid or in alkaline reaction. The first component may be either two molecules of the same diazotized amine or single molecules of two different amines, coupled successively.

Bleaching of Rayon

Dr. Kurt Goetze; Seide, 199, 33 (1928).—Although the bleaching of artificial silk and of goods containing it does not play so prominent a part in the textile industry as is the case with cotton, yet it is an operation which demands the greatest care and the most exacting labor. Many troubles from actual damage or at least unsatisfactory behavior of the material are to be traced to errors in the bleaching process. The following describes briefly the process as properly carried out and the factors to be considered in its practice.

The rayon is bleached either in skein form or as the finished goods, in the latter case mostly in mixed weaves. Skein bleaching needs to be carried out only when the goods to be manufactured from the fiber are to be pure white or if the skeins are to be dyed as such in light and lively shades. Most artificial silk spinners furnish already bleached material. But at present more and more unbleached material is being purchased from the manufacturers. This has the advantage, on the one hand, that the buyer can see by inspection with how much care the material has been spun, and, on the other hand, that artificial silk, which in the woven goods, mixed with other fibers, must be bleached again, does not have to endure a second bleaching, which rayon will usually not bear. It must therefore be pointed out that for the production of mixed weaves bleached artificial silk should never be used. Many defects in woven goods are to be ascribed to such double bleaching, and the bleacher cannot be held in any way responsible for damages which result therefrom.

For the bleaching of rayon, only oxidizing agents are employed. Hydrogen peroxide, sodium peroxide, sodium perborate, rarely potassium permanganate, or chlorine compounds, such as bleaching powder, sodium hypochlorite and activin, are used. Chlorine compounds are mostly employed. Hydrogen peroxide and sodium peroxide are used almost entirely in cases where goods mixed with silk or wool are to be bleached. For use, either the commercial 30% product is diluted to 3% or, on the large scale, prepared directly from barium peroxide. For this purpose, 11 kilos of sulphuric acid of 60° B. are diluted in leaded wooden vessels with 30 kilos of water and, after cooling, 1.5 kilos of hydrochloric acid of 20° B. are added; 17.5 kilos of barium peroxide, pasted up with 20 liters of water, are gradually stirred into the cold, diluted acid. By addition of about 40 kilos of ice the temperature is kept below 20° C. The almost neutral liquid is neutralized with sodium phosphate, run off from the precipitate, and diluted to 3%. The duration of the bleaching process depends upon the desired degree of bleaching. The preservation of the bleach liquid involves the observation of careful cleanliness, since through traces of slight impurities the peroxide is decomposed and loses, of course, in bleaching power. If one has no carboys available, tinned or tarred wooden vessels may be used for storage. Such a vessel is suitable, if the hydrogen peroxide, kept in it for fourteen days in diffused light and at room temperature, loses only about 0.01 to 0.02% in effective content.

Sodium perborate is used with advantage in cases where it is a question of getting a very noticeable soft feel on the finished goods. In using this reagent no copper or iron vessels can be used, as these metals decompose the perborate. On the other hand, vessels of lead, aluminum, zinc and, above all, nickel or tin, can be used. The bleach bath contains 2 parts of sodium perborate to 1,000 parts of water. To stabilize the solution, 0.66 part of sulphuric acid of 66° B., 4.7 parts of sodium silicate and magnesium sulphate are added, as well as colloids, such as glue, and flocculent precipitates. Further addition of soap, Monopole soap or Praestabit oil have been shown to have a favorable influence. The bleaching effect is directly dependent upon the temperature. The rayon is entered cold and the temperature raised to 30 to 35° C. during three to four hours.

Bleaching-powder solution of a strength over 1° B. should not be used for rayon. The material is wetted out in a hot soda bath (5%) and left for half an hour in the bleaching-powder solution. After rinsing, the goods are soured in hydrochloric acid, rinsed cold and hot once more, and to the last wash antichlor is added to the extent of 2% of the weight of the goods. Through bleaching in bleaching-powder solution the rayon assumes a straw-like feel, which must be softened by a hot soap bath. With Bemberg silk a pre-treatment with a bath containing 2 to 3% oxalic acid is advantageous.

Instead of bleaching-powder solution, however, sodium hypochlorite is mostly used. As the commercial "chlorine liquor" which is on the market, it contains only an extremely small amount of calcium compounds, so that one can use sulphuric acid for souring without fear of formation of calcium sulphate. If it is desired to prepare the hypochlorite in the works, this may be accomplished by reaction of bleaching powder with sodium carbonate, by bubbling chlorine gas into a solution of caustic soda, or by the electrolysis of a solution of common salt. The last procedure is certainly the best. In employing it the chlorine content should be brought to 20 to 25 g. of active chlorine per liter and this solution diluted to ½ to 1° B. Because of the free hypochlorous acid, which is always formed

to some extent through the process of electrolysis not running quite smoothly, the bleaching proceeds very successfully, because the free acid accelerates the bleaching process; time and chlorine are thus saved. The electrolytic chlorine liquor gives a handsomer effect upon the fiber than do other bleaching agents. It is best to work in almost neutral solution. If the solution is too acid, not only does damage to the fiber easily take place but the solution itself rapidly decomposes and becomes, of course, inactive. In such a case (when the solution is at first ascertained to be too acid) the reaction is corrected by addition of a suitable amount of caustic soda. The strength of the bleach liquor must be continuously watched. It may be mentioned here that testing with a hydrometer is not sufficient, because the common salt also present in solution leads to the calculation of a false value. One must therefore determine the chlorine volumetrically. For a plant without a laboratory the procedure of the Pyrgos Chemical Works * may be recommended: this makes possible a convenient titration of the active chlorine by reduction with sodium thiosulphate, Indigo Carmine serving as the indicator.

The Value of an After Treatment

In bleaching with electrolytic chlorine liquor, as well as with other agents, an after-treatment to improve the feel of the goods has to be resorted to. The feel can be imparted in various ways and in various degrees by hydrochloric, sulphuric, lactic or formic acids, as well as through use of different soaps and oils; while hydrochloric acid gives the softest feel, lactic acid gives the rayon a specially crackling feel. After-treatment with antichlor cannot be avoided in this case also. It is, however, worth while to use hydrogen peroxide instead of antichlor, and it can be added to the soap bath. By its use a bleach effect is super-added to what has already taken place.

If it be a question of an unusually rapid bleaching, potassium permanganate may be used. It must, however, be mentioned that permanganate is very expensive (technical permanganate is too impure for rayon bleaching), and, in the second place, it is very energetic in its action, and the fiber does not endure its action well. In addition, fiber bleached with permanganate tends to after-yellowing. Permanganate bleaching should not be employed unless the bleacher is previously warned of its danger. The reagent is never used at a strength over 0.1%, and is employed in neutral solution (which can be maintained by addition of magnesium sulphate to the bath) to avoid the formation of oxy-cellulose. After bleaching, the manganese dioxide formed is removed from the goods by means of bisulphite solution.

Favorable results are also obtained with activin. This product, sodium p-toluene-sulphone-chloramide, has been nicknamed "tame chlorine," because, in neutral solution, it occasions no damage to the goods even at the boiling point. Its solutions are extraordinarily stable, and can therefore be used as standing baths. Luster and feel of the rayon are not affected. For a light bleach, a bath may be used which contains 3 to 4% of activin, and worked at 60° to 70° C. Stronger effects are obtained in an acid bath at a lower temperature. For example, 3 g. of activin are dissolved in 1 liter of water, and 5 c.c. of acetic or formic acid added. The bath becomes milky, but this is of no practical significance. The artificial silk is left in the bath for one-half hour at the ordinary temperature, then rinsed, and after-treated with bisulphite of antichlor. With Bemberg silk, a pre-treatment bath of weak oxalic acid should be given. Artificial silk so treated behaves well on subsequent dyeing.

Bemberg silk, or goods containing it, are best bleached as follows: The goods are treated for 3 to 4 hours at 60° to 80° C. in a bath which contains 0.3 to 0.8% of oxalic acid. The goods are reeled a few times, but for the most part remain under the surface of the bath; then rinsed. The bleach-bath consists of a 0.4° to 0.8° B. hypochlorite solution. Duration of bleaching, 2 to 4 hours. After rinsing, the goods are soured with hydrochloric acid, rinsed again, and soaped at the boil. After lukewarm rinsing comes a brightening bath, which contains formic, acetic, or lactic acid and oil emulsions, according to the effect desired. The process is also suited to other artificial silks.

With piece goods a definishing must precede the actual bleaching. The method of definishing varies according to the kind of finish which has been employed. Complete removal of the finishing agent is of the greatest importance, since incompletely definished goods are liable to inequality in results in the subsequent bleaching, and, above all, in the dyeing. Frequently, streaky dyeings are to be ascribed solely to incomplete removal of the finishing agent. For the finishing of artificial silk, different kinds of starches, gelatine, saponifiable and unsaponifiable oils, such as linseed oil and paraffine oil, are used. Since linseed oil unquestionably gives the finest finish, very many lots of piece goods finished with it will come in to be bleached. It is always well to ascertain what particular finishing agent has been used. Starch is best removed by diastase to 1 liter of water, and which has been made slightly acid with acetic acid. The entering takes place at 40° to 50° C., and the bath and contained goods allowed to cool down of themselves. Temperatures of over 65° C. must be avoided, as well as the formation of an alkaline reaction, since otherwise the action of the diastase ceases entirely. On the following day the goods are rinsed and soaped. Gelatine is removed by long soaking in warm water. Only after several hours is the bath to be brought to a boil. Saponifiable fats are removed by a soap bath, to which have been added 5 c.c. of ammonia water per liter of bath, and 5% of Nekal AEM or Tetrapol. If paraffine or

*Chem. Ztg., 337, 51 (1927).

waxes are present, the goods are treated at the boil for 40 to 50 minutes in a bath of Marseilles soap, to which has been added 3 c.c. of turpentine and 3% Nekal BX per liter. The finishing agent, thus removed, rises to the surface of the bath, and is easily removed by skimming, or by letting the bath boil over. Linseed oil finish is removed by boiling with soap solution of 5 to 10 g. per liter. It may be noted that goods finished with linseed oil and stored for a long time often cause difficulty in the definishing, on which account the finishing is now carried out somewhat differently than formerly.

Bleaching gives rise to special difficulties, if one is dealing with colored goods. There are very few dyestuffs whose dyeings withstand all bleaching methods. Above all is the boiling-out process with soda solution dangerous. Boiling out with caustic liquor must naturally be avoided under all circumstances, for through the breaking-down effect of caustic upon the cellulose or accompanying substances, or upon the finishing egents present, reducing agents might be formed, which would destroy the dyestuff. Even Indanthrene dyestuffs do not endure the process. They become partly reduced to the leuco form, the dyeing becomes paler, and the dissolved leuco compound goes on and dyes the undyed parts of the goods. To avoid this difficulty, oxidizing agents, such as perborate or Ludigol, are added to the boil-off bath; for example, 16 kilos of soda and 2 kilos of Ludigol dissolved in 1,000 liters of water make a good bath.

The bleaching of rayon fiber is mostly carried out in wooden vessels, or better in cement vessels lined with porcelain tiles. The material is worked about by hand, or mechanically, or merely laid into the bath. The ordinary forms of dyeing machinery are well adapted for bleaching, souring, and washing. Piece goods are likewise bleached in tubs, or machinery specially designed for the purpose may be used.—(*Translated.*)

A BAFFLING SEARCH BY SCIENCE

By Elizabeth Cole

SINCE the discovery of the tubercle bacillus in 1882 by Robert Koch, an obscure German physician, scientists all over the world have been searching for a cure for tuberculosis. Dr. Koch thought he had found one in tuberculin which he discovered several years later, and the news was broadcast with rejoicing. Some physicians to-day use this serum cautiously, but tuberculin is by no means a cure. We have had countless other serums and anti-toxins offered by scientists who have been sincere in their beliefs that at last they had found a cure. Spurts of hope, they were, that quickly flickered out.

And yet doctors and scientists are not discouraged. They believe that there is a specific to cure tuberculosis awaiting discovery. Because they believe this so firmly, some of the funds derived from the sale of Christmas Seals each year are devoted to co-operative research work, under the direction of a Committee on Medical Research. This committee at the annual meeting of the National Tuberculosis Association and its affiliated state and local associations, held in Portland, Oreg., last June, reported that, as a result of the work in the chemical analysis of the human tubercle bacillus accomplished during the past year, "we are on the threshold of our final journey." Good news, indeed, and yet how slowly is the progress made!

Research work is conducted in the best laboratories throughout the country. Manufacturing plants where enormous quantities of bacteria are being grown for chemical analyses and later for biological study, have contributed generously toward this co-ordinated research work. One house had 2,000 bottles of tubercle bacilli growing at one time and these had been bred on a carefully composed chemical medium. Universities, colleges and clinics, as well as interested laymen and doctors have helped enthusiastically in the work. They all feel that through teamwork the cure for tuberculosis will be discovered.

Until a specific or cure has been found, however, it is most important to employ the only known treatment we have found effective so far. That is not a bottled medicine, a pill nor a serum—it is the combination of absolute rest to heal the scar tissue, good foods, sunshine and fresh air under the direction of a competent physician.

Until the baffling search has been successful, it is necessary for the public to be patient, use the best known methods for cure, and contribute intelligent interest in the search. A timely way to help is to buy and sell the penny Christmas Seals in December.

BRITAIN INCREASED DYE OUTPUT IN 1927

The production of dyestuffs in Great Britain during 1927 shows a substantial increase over the 1926 total, according to a report just received from Trade Commissioner H. S. Fox, London. The figures given represent practically all of the country's dyestuffs production, the output of the firms not making returns being understood to be negligible. The report in full has been issued by the Chemical Division as Special Circular 210, "British Dyestuffs, 1927," and interested firms may obtain copies upon application to the nearest district or co-operative office of the Bureau of Foreign and Domestic Commerce.

NEW FABRIC CONTAINS PAPER AND METAL

An entirely new fabric has recently been produced in Germany, according to a report from the Vice-Consul at Stuttgart, B. A. Perkins.

While the exact composition of the new fabric is unknown, it includes paper, a textile fabric, and one or more metals. The top surface has the appearance of metal, but the back surface has the appearance of paper, and it may be bent or folded without cracking.

The new fabrics, it is said, may also be embossed

or printed upon by ordinary printing methods, and is made in a variety of colors. It is said not to oxidize or tarnish.

The new fabric is claimed to have a wide range of uses. Thus far the principal ones suggested for its utilization are: Quality cardboards, confectionery boxes, trunk linings, fine packing for cosmetics, placards, picture frames, book binding, fancy ball shoes, stage decorations and wall-paper.

THOMPSON WITH WALKER & DAVIS

J. H. Thompson, for seventeen years with the Hussong Dyeing Machine Company, Groveville, N. J., recently severed connections with that firm to join the organization of Walker & Davis, Inc., of Frankford, Pa., engineers and manufacturers of circulating and rotary machines for dyeing, bleaching and other processing operations.

Mr. Thompson first became associated with Morris & Co., of Groveville, in 1910 in the capacity of selling agent for cotton duck and specialties. The company had acquired the Hussong Dyeing Machine plant in 1907, but the plant had been inoperative at the time Mr. Thompson joined the firm. While in this connection, however, and during the past seventeen years, he practically had full charge of the dyeing machine division, which was operated under the name of Hussong and managed by Mr. Thompson until last August. William McK. Morris, the treasurer of Morris & Co., died in the spring of 1927 and changes in the directing board of the company followed.

Mr. Thompson has purchased an interest in the business of Walker & Davis. He has been elected vice-president of the company and a member of the board, and will personally direct the activities of the company.

NEW INDIGOSOL PRODUCTS

Four color cards describing the application of several new products of the Indigosol series manufactured by Durand & Huguenin, S. A., of Basle, have been issued by the Carbic Color & Chemical Company, American agents for the Swiss dye firm.

Two assistants for use with a new Indigosol printing method have been announced under the names of Indigosol Developer D and Developer GA. The first is a yellowish, water-soluble liquid with a slight acid reaction, used chiefly in combination with the second for the printing or padding of the difficultly soluble Indigosols. The GA developer is a thin, combustible neutral liquid used as a solvent.

Two new colors in this series, Indigosol Red Violet IRH and Green AB, are fully described as to fastness properties, printing and dyeing methods, etc., and the cards display very attractive samples in stripe and pattern effects. Complete printing recipes are also given.

Another circular describes a process for the production of fast chlorate discharges with Indigosols on Indigo and padded chrome mordant colors. Several patterns in three colors are displayed as effects obtained by this method and a number of printing recipes are included in the text of the circular.

TO TALK ON SILK-WEIGHTING

Piece goods standardization, the weighting situation and registration of designs are among the subjects which will be discussed at a luncheon-meeting of the Broad Silk Manufacturers' Division of the Silk Association of America, Inc., to take place December 13 at the Advertising Club, 23 Park Avenue. G. H. Conze, of the Susquehanna Silk Mills, will speak on weighting; Carl Lang, of Lang & Lewin, Inc., on piece goods standardization, and Robert Blum, of the United Piece Dye Works, on registration of designs. Paul C. Debry, chairman of the division, will preside at the meeting.

M. J. Lane, for the past nine years with John Campbell & Co., has resigned and is now connected with the Boston branch of the Geigy Company, Inc.

The directors of the J. P. Devine Manufacturing Company, Inc., at a special meeting of the board held at Buffalo elected Charles P. Devine president of the company. Mr. Devine fills the vacancy caused by the recent death of his father, the late J. P. Devine, founder of the organization and universally recognized as one of the leading and most successful pioneers in the process field.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

AVAILABLE IMMEDIATELY

Available immediately as dyer or chemist. Extensive experience with vat colors on all types of fabrics, also rayon and mixtures. Experienced in analyses, chemical control, and experimental and development work. Address: Classified Box 489, American Dyestuff Reporter.

FADE-OMETER WANTED

Wanted—Used Fade-Ometer in first-class condition. In reply kindly state model and serial number. Address: Classified Box 493, American Dyestuff Reporter.

AN OPPORTUNITY

An excellent opportunity is open for an A-1 Dyestuff Salesman with an established trade to join an old-established firm on a profit-sharing basis. If successful a firm membership may be in order. Address, in strict confidence: Classified Box 492, American Dyestuff Reporter.